American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

OCTOBER 22, 1956 PRICE 50 CENTS

Tracer boring a plastic mold section — see page 2

Grinding Stresses . . . Plastic Molds

AUTOMATION SIMPLIFIED

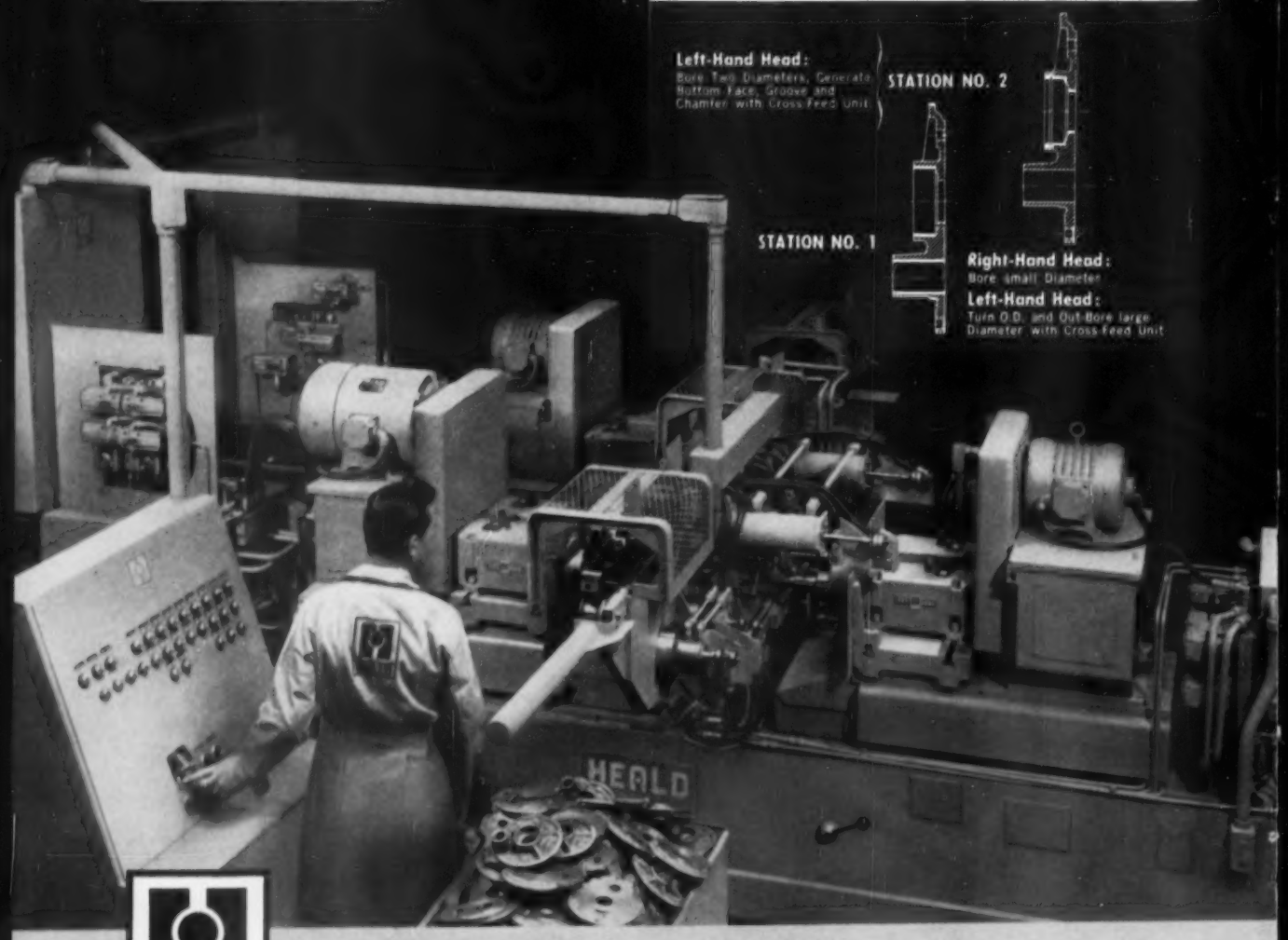
Two-Station Automated Multi-Unit Bore-Matic precision finishes 8 different surfaces at 140 parts per hour

The versatility of Heald Borizing, and the ability to perform several different operations simultaneously at a single station can contribute to the simplicity and economy of an automated production line.

The Multi-Unit Bore-Matic shown here, for example, can do in just two work stations what might otherwise have required more machines and a more extensive workhandling system. In this simple setup, cast iron pump covers are bored, turned, faced, grooved and chamfered at 140 parts per hour at 75% efficiency. Two parts are Borized simultaneously at each station and all operations except initial loading and final unloading are fully automatic.

For Automation that pays its own way . . .

IT PAYS TO COME TO HEALD


Left-Hand Head:
Bore Two Diameters, Generate Bottom Face, Groove and Chamfer with Cross-Feed Unit
STATION NO. 2
STATION NO. 1
Right-Hand Head:
Bore Small Diameter
Left-Hand Head:
Turn O.D. and Out-Bore Large Diameter with Cross-Feed Unit
HEALD

HEALD

THE **HEALD** MACHINE COMPANY

Worcester 6, Massachusetts

Subsidiary of The Cincinnati Milling Machine Co.

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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Cover . . .
Out-of-round revolving pattern serves as master for tracer boring a mold section for plastic radomes at Zenith Aircraft. Lathe is a special 60-in. sliding-bed gap lathe built by Axelson. Tracer is Turchan hydraulic. For further details on this and other out-size machines at Zenith, see page 121.

Turbine Talk . . . Early last year, Elmer Tangerman paid a visit to the Gas Turbine Dept of General Electric at Schenectady. Initially, it was a casual visit but it led to Tange's report on operations there (*AM*—Jun 6 '55, p137) that not only gave you some good production ideas but an insight into the growing role of the stationary gas turbine. We remind you of this now because gas turbines are much in the news with the trial runs of the *John Sergeant*.

The John Sergeant is a Liberty ship that has been in mothballs since World War II. She has been rebuilt with a 6000-hp gas turbine and a new bow, 20 ft longer than the old, to improve her seaworthiness in the North Atlantic gales. In the trial runs she has developed 7575 hp and reached a speed just over 18 knots (compared with the former 10 knots). Not the least of her innovations is a reversible-pitch propellor that permits the turbine to operate continuously in one direction without the need of reversing gears.

On one of the trial runs, we went along to observe the performance. With the John Sergeant going full-speed ahead, the captain gave the order for a crash stop. Within 15 sec the propeller had been reversed and in 2 min 38 sec the ship had been brought to a stop (about 625 yards) and then started to back down her own wake. This represents a world's record for crash stops. The gas turbine-reversible prop combination represents a tremendous advance in marine propulsion. You can see a picture of the turbine and prop in the news story on page 172. One of the features of the trial run was that at its conclusion we received the traditional fire-boat welcome as we slid into New York Harbor. It was a bit damp.

Shipbuilding is only one of the many facets of Metalworking that come in for attention in our pages this week. Tange has made a study of the developments in drill making at Morse Twist. De Groat and Le Grand continue the series on the new techniques in building next year's cars, and there are a couple of stories on the aircraft industry. Each of these contain ideas you may be able to use, but there are, as always, a number of articles dealing with developments in the basics of metalworking operations: a study of grinding stresses, how to make plastic springs, and how to appraise accuracy in measurement are examples.

Coming . . . *AM* for Nov 5 will feature the concluding part of the series on "New Techniques Build '57 Cars." The Special Report will be a checklist for press-tool design. In addition there will be articles on getting and keeping military contracts, bending co-axial tubing, secondary operations, the best number of teeth for milling, and other subjects. The cover will show an unusual application of TV to Metalworking.

Col William J Darmody, former mechanical engineer with the National Bureau of Standards and retired chief of the Army Ordnance Gage Center at Frankford Arsenal, has served since 1952 as a part-time technical consultant to The Sheffield Corp. A native of St Paul, Minn, Col Darmody studied engineering at the University of Minnesota, where he was graduated in 1924. For the next 16 years, he was employed in the Bureau of Standards as a specialist in metrology, gages, and precision instruments. Called into active duty as an army reserve officer in 1940, he became technical director of the Army Ordnance Gage Lab.

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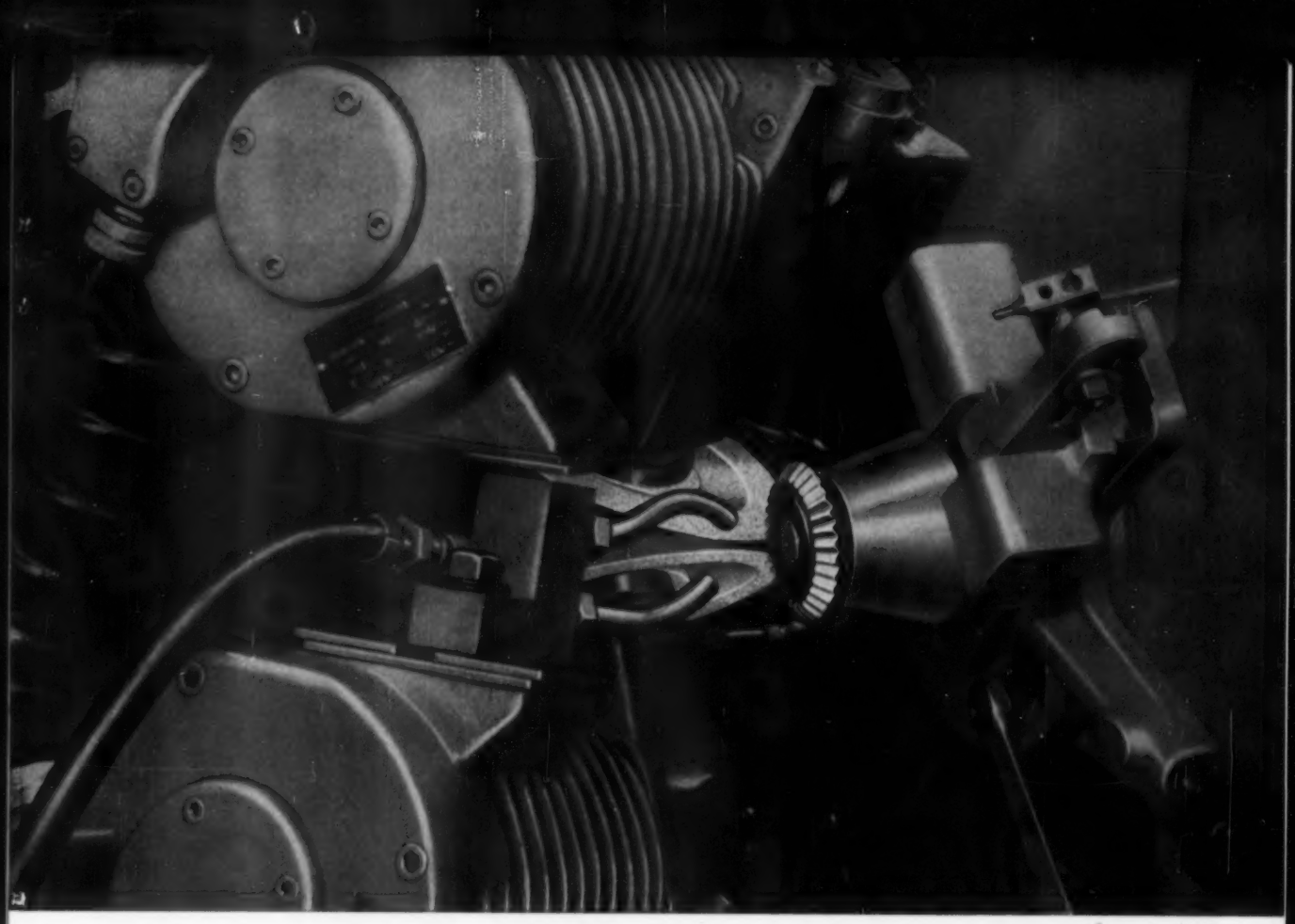


Now you can grind straight bevel Coniflex® gears

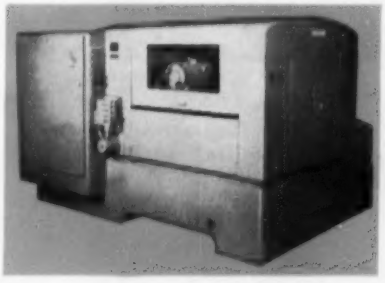
You can *now* use hardened and ground straight bevel gears for many angular drives requiring extreme precision and load carrying capacity.

The new Gleason No. 105 Straight Bevel Coniflex* Grinder generates gears with the highest accuracy of spacing and profile, with the tooth profile, fillet radius, and tooth bottom formed into one smooth blended shape by two grinding wheels.

And gears ground on the No. 105 Grinder after hardening *maintain their extreme precision* even under continuous load operation.

Wet-type grinding on this machine provides fast cycles and excellent finish. Set-up calculations are simple. The completely automatic cycle of the No. 105 Grinder not only assures uniformity of production but also provides great savings in time and production costs.

We will gladly send you more information about the No. 105 Straight Bevel Coniflex Grinder upon request.



The No. 105 Grinder accommodates straight bevel Coniflex gears up to 8½" pitch diameter, 3DP with ratios up to 6:1, cone distances up to 4¼". Gears 20DP and finer may be ground directly from the solid; coarser pitches are ground after semi-finish cutting and hardening.

* Straight bevel gears with localized tooth bearing.

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Toolmaster

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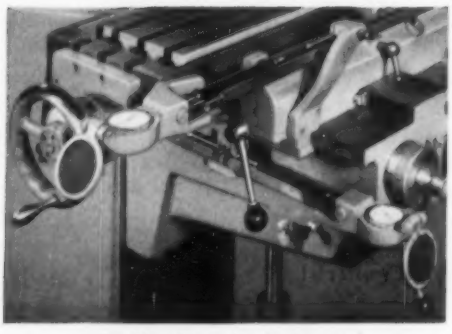
1) Swivel Vise, 2) Cutter Illuminating Attachment

Shaping Attachment

Overarm Adapter



Precision Measuring Equipment

CINCINNATI

Attachments

Stretch Toolmaster Versatility

Over More Jobs

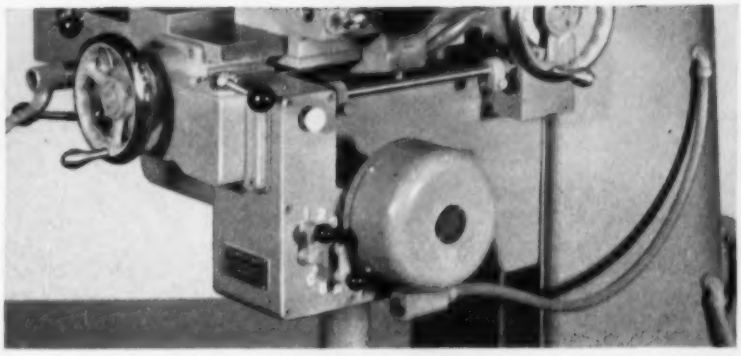
CINCINNATI

. . . and give you an opportunity to reduce the cost of dozens of machining operations performed on CINCINNATI Toolmaster Milling Machines. Eight of these attachments are illustrated here. You will find others just as profitable for your toolroom in the following list:

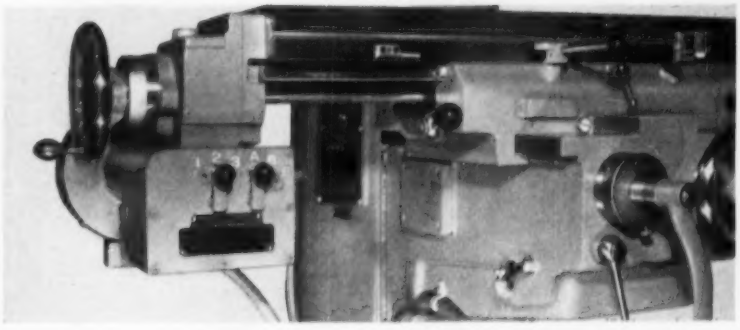
- **Power feed to table**
- **Power feed to saddle**
- **6" extra table traverse**
- **Shaping attachment**
- **Shaping tools**
- **Precision measuring equipment** (longitudinal, cross, vertical, or combinations)
- **Overarm adapter** (intermediate swivel)
- **Vises**
- **8" index head and tailstock**
- **Quill feed for 1C machine**
- **Cutter illuminating attachment**
- **Cutting fluid pump**
- **Straight cylindrical collets** (inch and metric sizes)
- **Taper hole collets**
- **Adapter for small collets**
- **Adapter for straight shank cutters**
- **Drill chucks**

You may obtain more information about Toolmaster's versatility, its rugged construction, and the fine array of attachments available by writing for Toolmaster catalog No. M-1870-3.

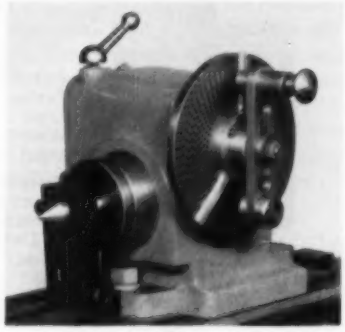
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



Power Feed to Saddle



Power Feed to Table



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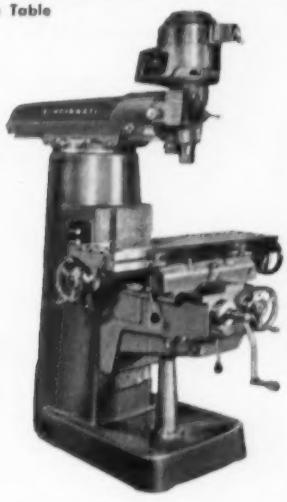

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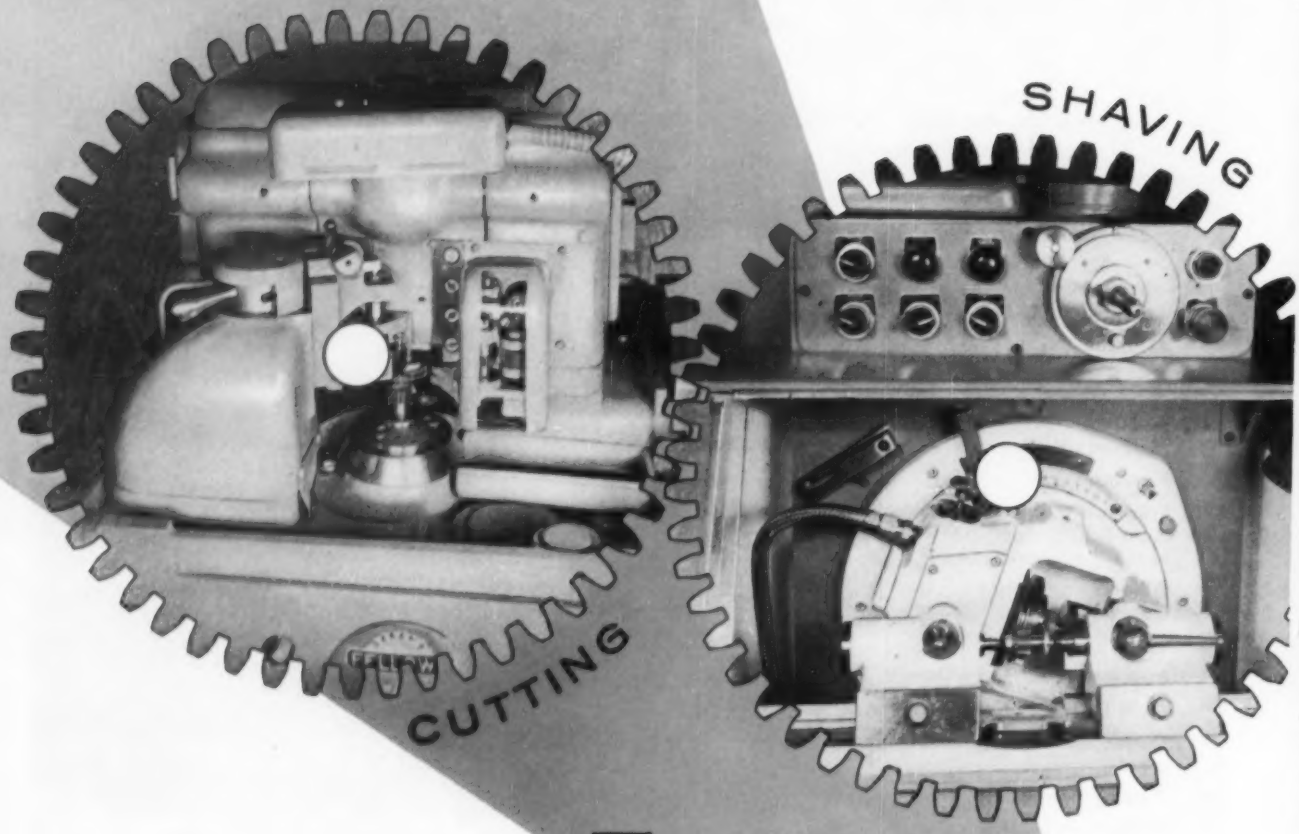

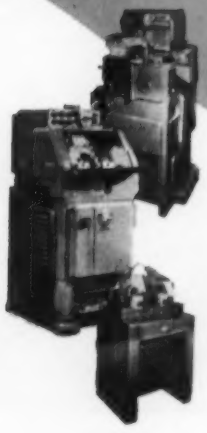

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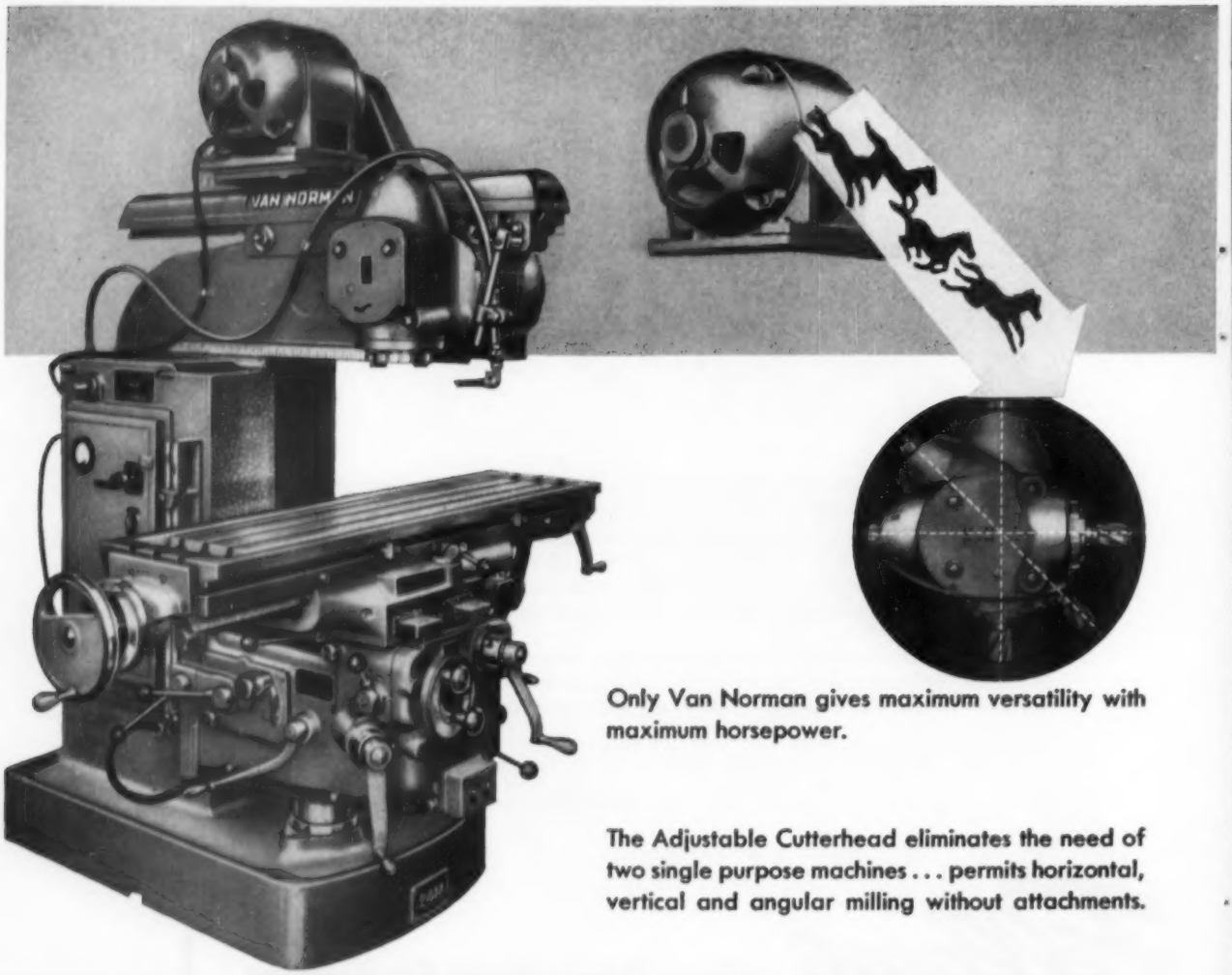

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=2 Single Purpose Machines

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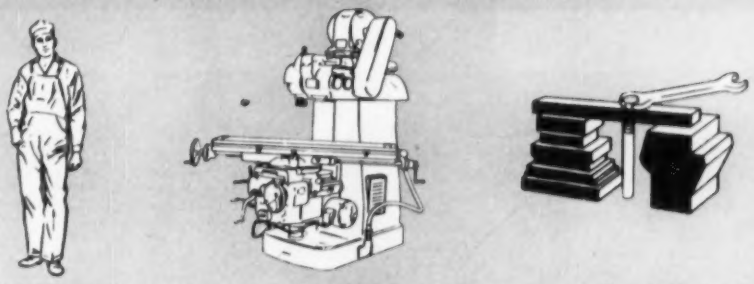
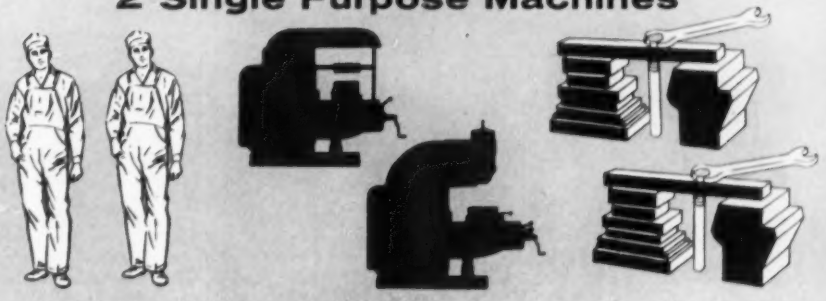


1 Operator | 1 Machine | 1 Complete Setup

or

2 Single Purpose Machines



2 Operators | 2 Machines | 2 Complete Setups

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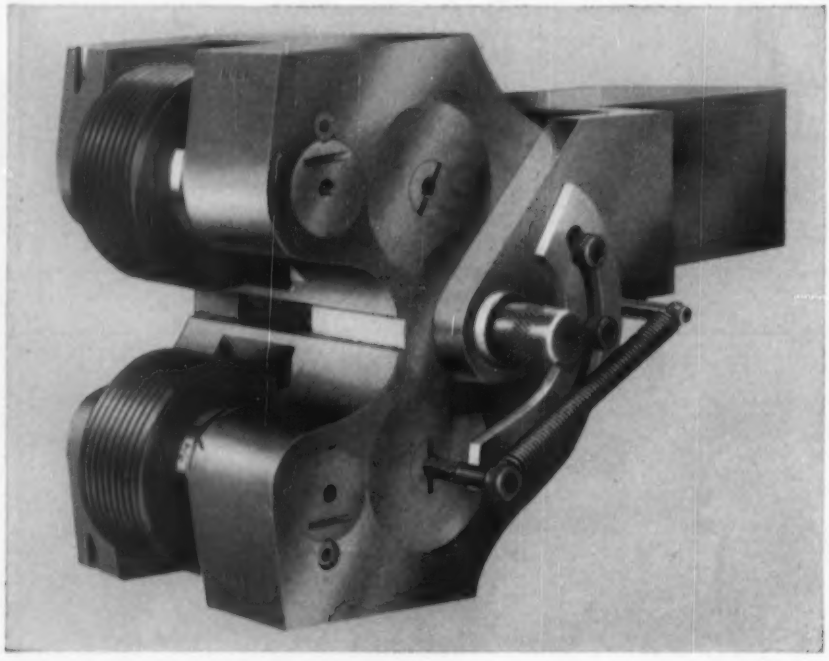
Coarse Pitch Threads Rolled to Class 4 Fit..



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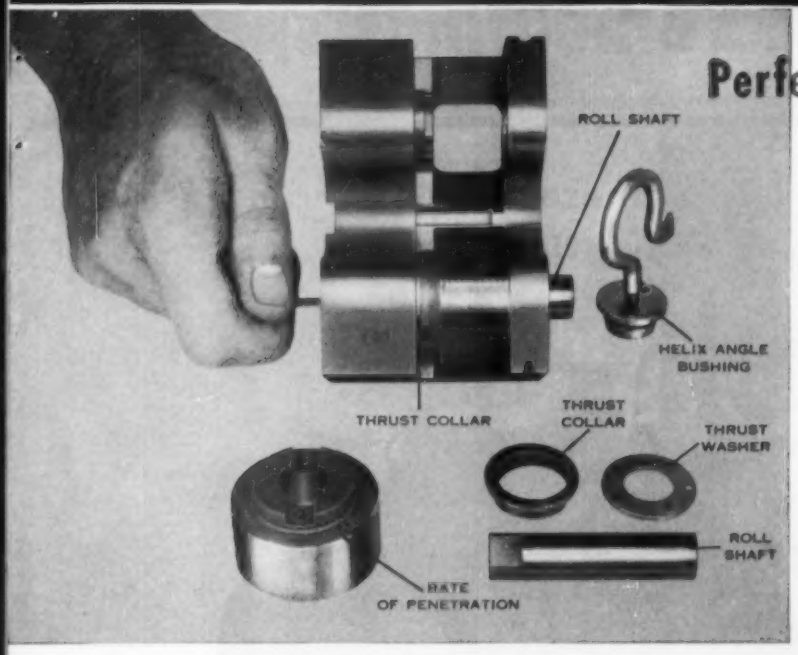

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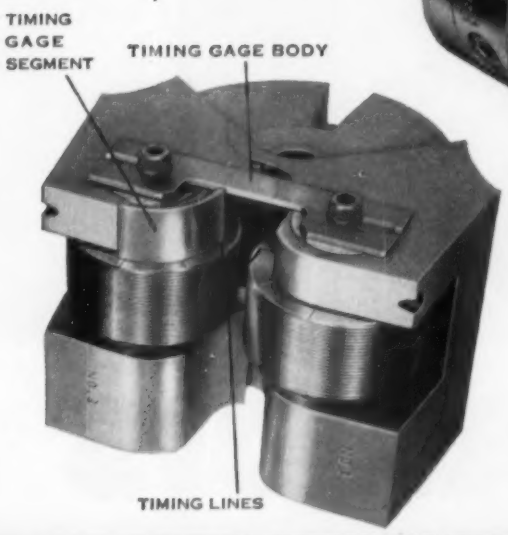

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A simplified system of roll timing ensures satisfactory rolling on the first operation. Only one gage is used for timing all threads rolled by each attachment. Rolls are correctly timed when roll lines coincide with the vertical of the curved timing gage segment (illustrated).

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Exclusive Landis microsphere bearings on <u>both</u> grinding and regulating wheels

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LANDIS

precision grinders

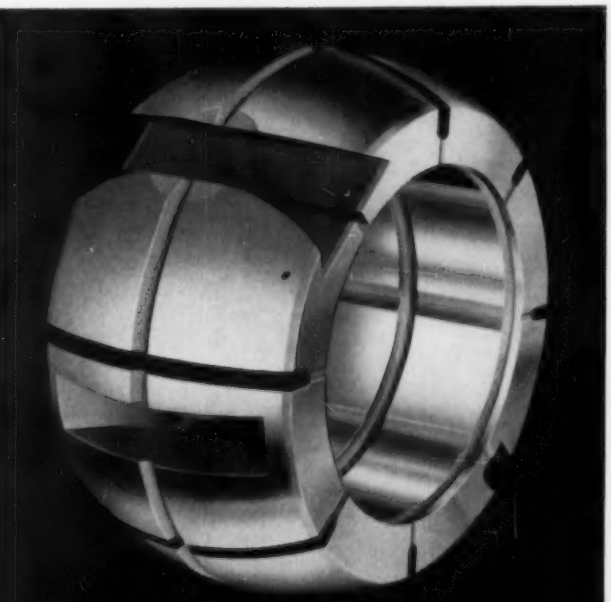
centerless production... lower costs

Quick, positive sparkout
... for faster grinding cycles

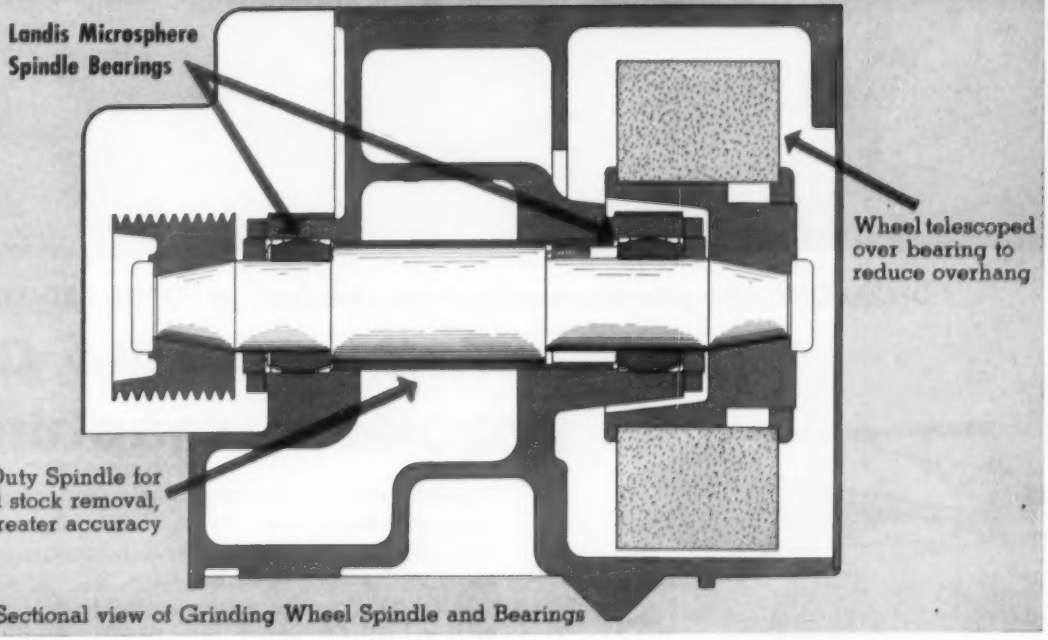
Close running clearance
... for fine finishes

Simple, one-piece construction
... trouble-free operation

Increased rigidity
... heavier cuts to closer tolerances

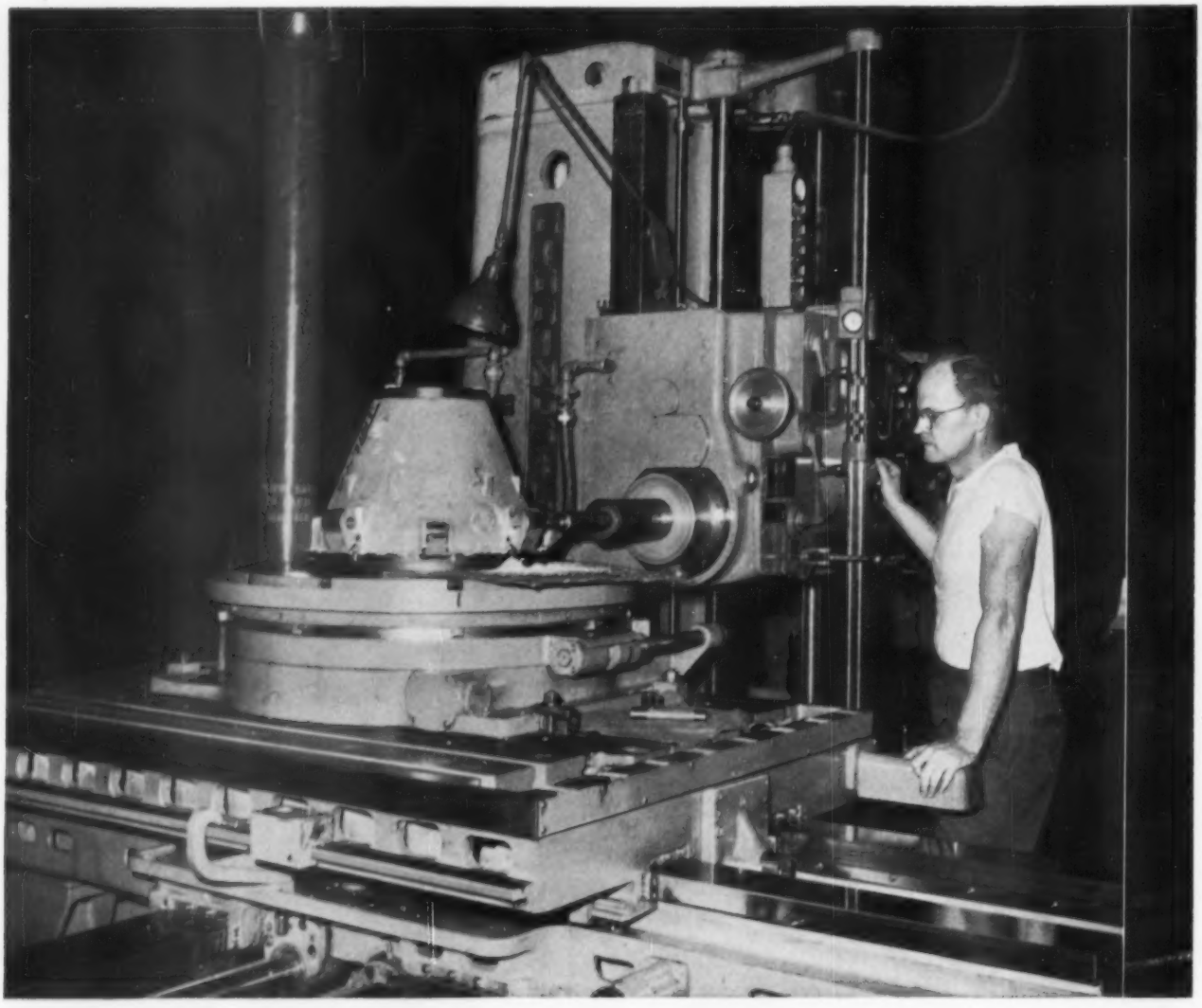


Landis Microsphere Bearing



Sectional view of Grinding Wheel Spindle and Bearings

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA



OPERATIONS: drilling, boring, reaming of upper housing **MACHINE: G&L Model 340-T**

2 versatile G&L precision machining

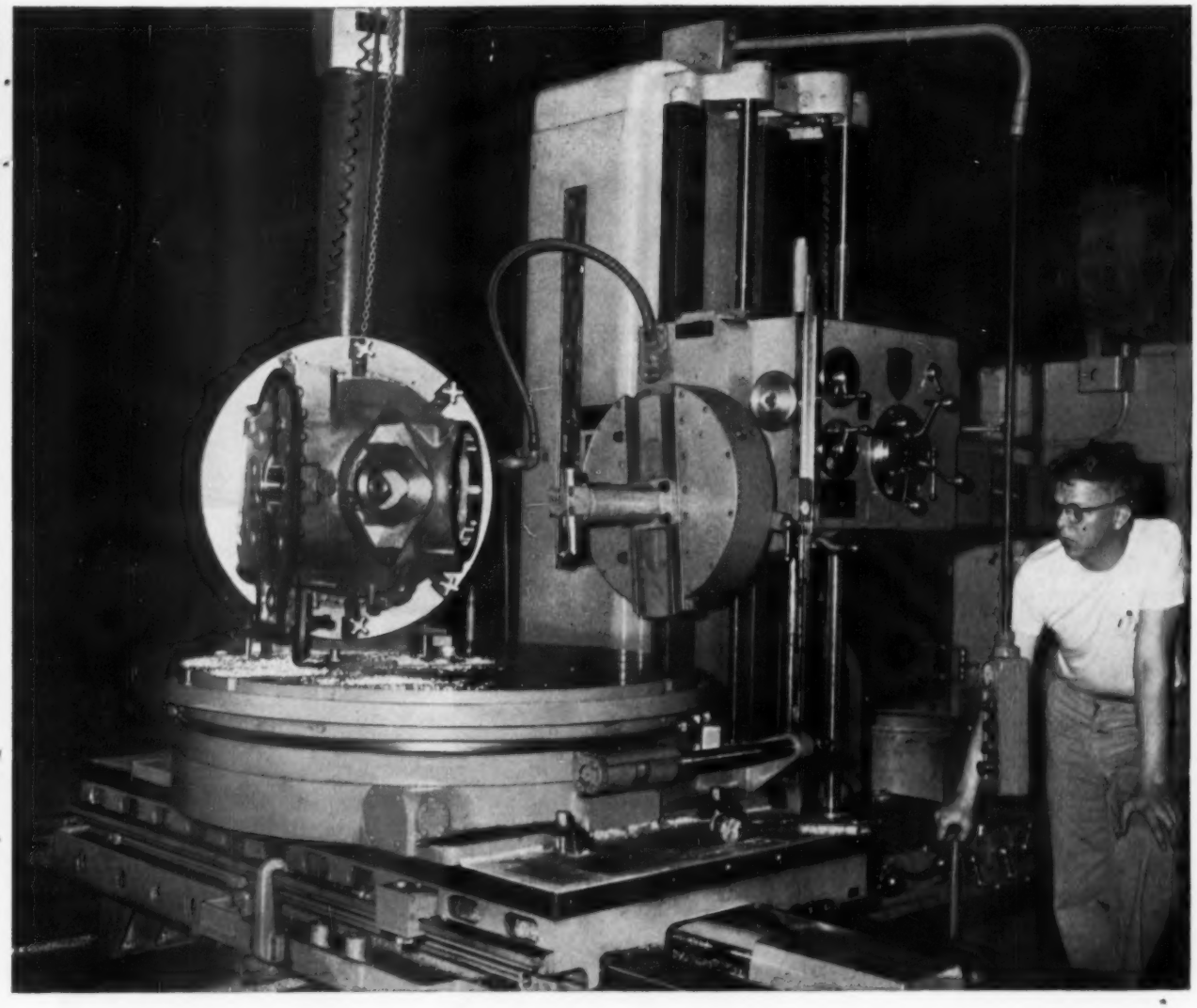
Precision-machining to tolerances within .001″ in a single set-up. That's what Indiana Gear Works, Indianapolis, is getting with two highly versatile Giddings & Lewis horizontals, producing intricate housings for Sikorsky helicopters.

Model 340-T, equipped with a 4-inch spindle, drills, bores, reams and mills four equally-spaced lugs (90° apart) on the upper housing. And the Model 300-T with a 3-inch spindle and continuous feed facing head, precision turns, bores and faces two holes — 10.503″ and 4.377″ in diameter — on the lower housing.

G&L and HYPRO DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO.

Fond du Lac, Wisconsin



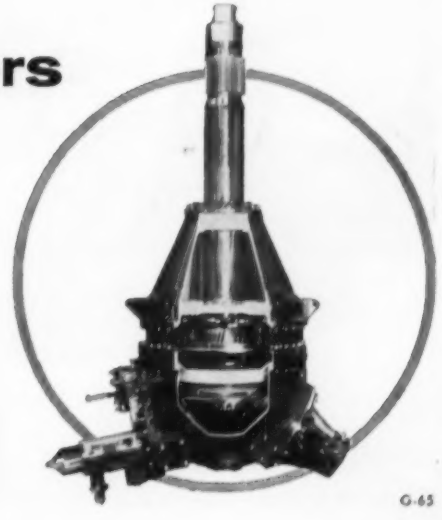
OPERATIONS: turning, boring, facing of lower housing **MACHINE: G&L Model 300-T**

horizontals perform for Sikorsky helicopters

Both workpieces require machining to tolerances within .001" in a single set-up.

The two horizontals, illustrated here, also feature G&L's rotary indexing table and the improved measuring device which facilitates accurate positioning through the use of measuring rods and dial indicators.

If you, like Indiana Gear Works, require precision production of intricate components, you can do it on a G&L horizontal. Call in your G&L representative. He'll be glad to help you get results.

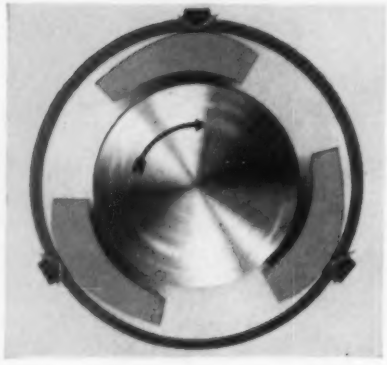


G-65

• • • • *Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX machines.*

Cincinnati's setup timesavers reduce cost of your

1



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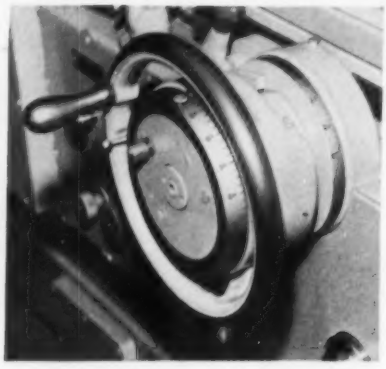
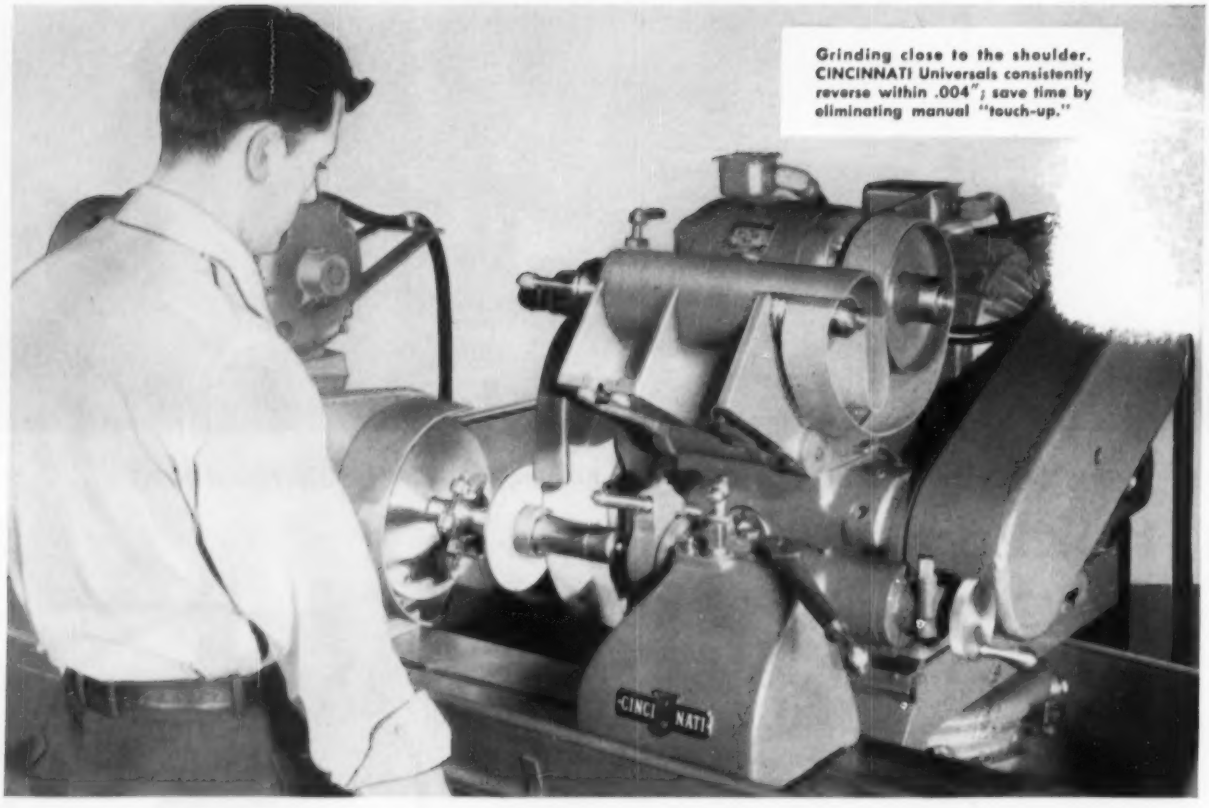


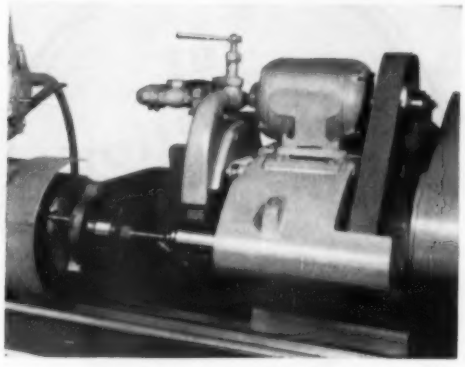


Grinding close to the shoulder. CINCINNATI Universals consistently reverse within .004"; save time by eliminating manual "touch-up."

CINCINNATI

small lot precision grinding

3



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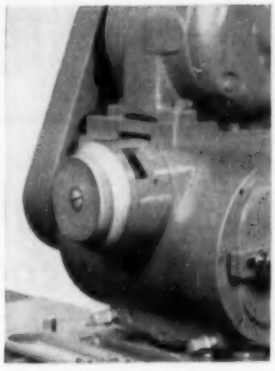


Small manufacturing quantities may be good for inventory accounting, but they're tough on costs. In precision toolroom grinding, CINCINNATI® FILMATIC Universals offer several ways to eliminate or greatly reduce the setup element of cost.

5

1 FILMATIC **grinding wheel spindle bearings** require no adjustment for any job assigned to the machine.

2 **Two-speed cross feed mechanism** facilitates multiple diameter grinding; incorporates pick-feed all the way to final size.

3 **Internal grinding unit** is hinged at the front of the wheelhead casting, always ready for internal work.

4 **Instant work speed selection** for the diameter being ground. Just turn the dial with one hand, that's all there is to it.

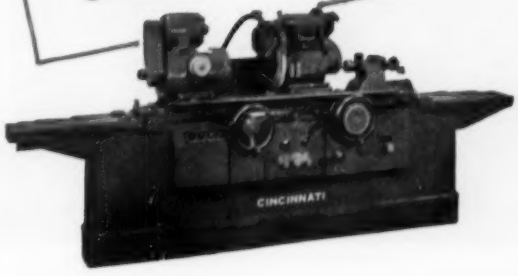
5 **Power rapid positioning** of wheelhead. Saves time and energy, especially when setting up for widely varying diameters (extra equipment).

Other ways in which new CINCINNATI FILMATIC 12", 14", 18" Universal Grinders can reduce costs in your shop are outlined in catalog No. G-663. May we send a copy to you? You will find brief specifications in Sweet's.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

FILMATIC

CINCINNATI® FILMATIC 12" X 36" UNIVERSAL GRINDING MACHINE

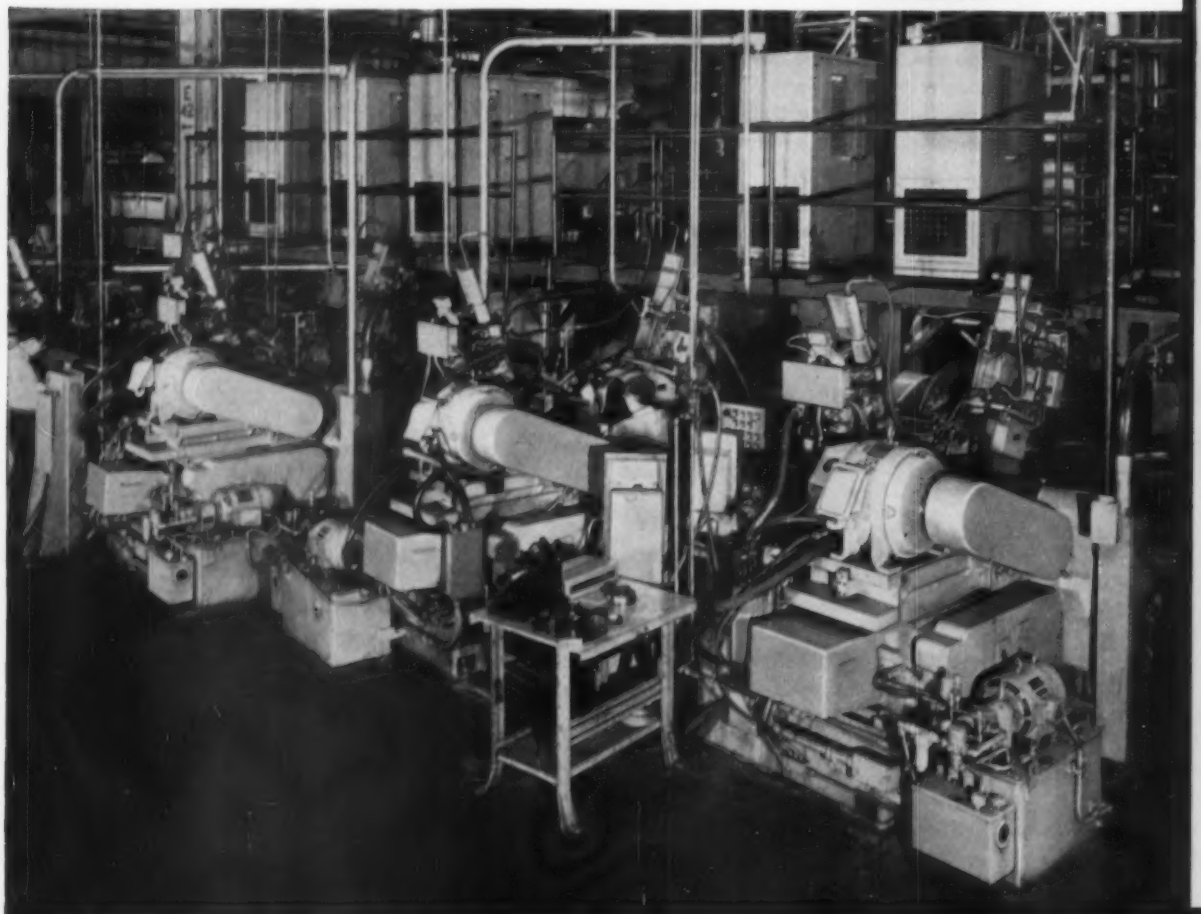


CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

In this leading automotive plant...Norton Multi-Wheelslide Grinders

Type CMS-1 Semiautomatics eliminate separate grinds on separate machines

cut production time and costs



A BATTERY OF NORTON TYPE CMS-1 GRINDERS. Four of five Semiautomatic Multi-Wheelslide Cylindrical Grinding Machines in the Michigan plant of a big automotive manufacturer. Type CMS-1 machines may be set up with opposed wheelslides, as shown here, or wheelslides may be positioned in line if the job requires. Each wheelslide mounts one or more 30" grinding wheels. Slides operate in unison during production, but may be individually controlled for set up.

The Type CMS-1 Semiautomatic Multi-Wheelslide Cylindrical Grinder is a typical example of how Norton builds profit-boosting "Touch of Gold" advantages into grinding machine performance.

By grinding multiple diameters with top speed, accuracy and economy this ultra-modern machine easily replaces two *or more* ordinary grinders. Features like these tell you why:

- *Central, one-lever control of the automatic grinding cycle — plus automatic, electrically timed termination of the cycle — for greatly simplified operation.*
- *Two-rate automatic feed assures ideal conditions for rapid stock removal, with highest accuracy and finish.*
- *Convenient wheel feed hand wheels have "click-count" indexing, permitting feed adjustments in "tenths". This simplifies size control in setting-up and initial operation.*
- *Individual wheelhead mounted truing devices operate consistently at predetermined speed and feed. Control of abrasive removed is close and uniform, with compensation of wheelslide setting for wheel diameter reduction. The result is efficient, effortless truing, with reduced wheel cost per piece ground.*

THE "TOUCH OF GOLD" IN ACTION. A close-up of one of the Type CMS-1 Grinders in the larger photo. The job (shown schematically in the inset below) is grinding two bevelled 6" O.D.'s on an internal ring gear, with stock removal of .025". The fast production time on this operation is reported as follows:

FLOOR TO FLOOR TIME: 49 seconds, including load and unload. *Dressing Time:* 2½ seconds per piece, based on eight pieces per dress. *Total time, including dress:* 51½ seconds or 70 pieces per hour at 80% efficiency.

Improve Your Competitive Position

Replace your obsolete grinders with new high production, high efficiency Type CMS-1's — and meet competition with the best equipment in the field. Remember: only Norton offers you such long experience in both grinding machines and grinding wheels to help you produce more at lower cost. Ask your Norton Representative for Catalog No. 1800-1, or write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make your products better

District Offices: Worcester • Hartford • Cleveland Chicago • Detroit

NORTON PRODUCTS: Abrasives • Grinding Wheels Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes

New Kearney & Trecker's

Controls on new TF Series milling machines are conveniently grouped up-front where they belong — to speed production . . . assure accurate settings . . . reduce operator fatigue

Available under Tool-Lease program

TF Series
Model 210 Plain Milling Machine

POWER — 10hp spindle drive; 3hp feed and rapid traverse drive
TABLE WORKING SURFACE — 62" x 14"
FEEDS — (32) ⅝ to 90 ipm
SPEEDS — (24) 15 to 1500 rpm
WEIGHT — 9200 lbs.

ONE look tells why the new TF Series milling machines — Plain, Universal and Vertical — are so easy to operate. "Bull's-eye" up-front control grouping permits operators to achieve exact settings faster, more adeptly and with greater ease than ever before. This "Fron-Trol" convenience is the key to low-cost production . . . because it increases the operator's efficiency and measurably reduces fatigue through elimination of wasted steps.

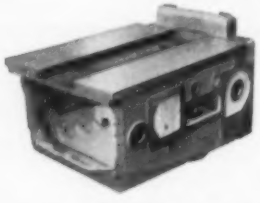
The "bull's-eye" knee and saddle-mounted controls are safety-interlocked and include feed selection, directional Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, front-mounted table handwheel, saddle clamping gib and backlash eliminator, and hand and power directional controls for knee and saddle movements.

In addition, the new TF's give you a superior combination of outstanding design and operating features never before available on any other knee-type milling machines. They're built in five sizes — No. 2 to No. 6 from 10hp to 50hp.

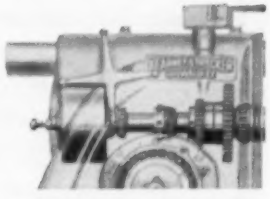
Why take less than the latest when you want new milling machines? You can get all the facts on new TF Series machines from your Kearney & Trecker representative—call him or mail the coupon to factory today!

A few more of many reasons why TF Series milling machines are so easy to operate

Twin Screw Knee Support — Exclusive double-support arrangement most effectively distributes weight of the new machines' much larger, wider, heavier knee, saddle and table. This balanced design substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . halves the wear factor, assuring greater, longer-lasting accuracy.



Heavier, Wider, One-Piece Knee — The *Twin-Screw* arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . longer-lasting accuracy.



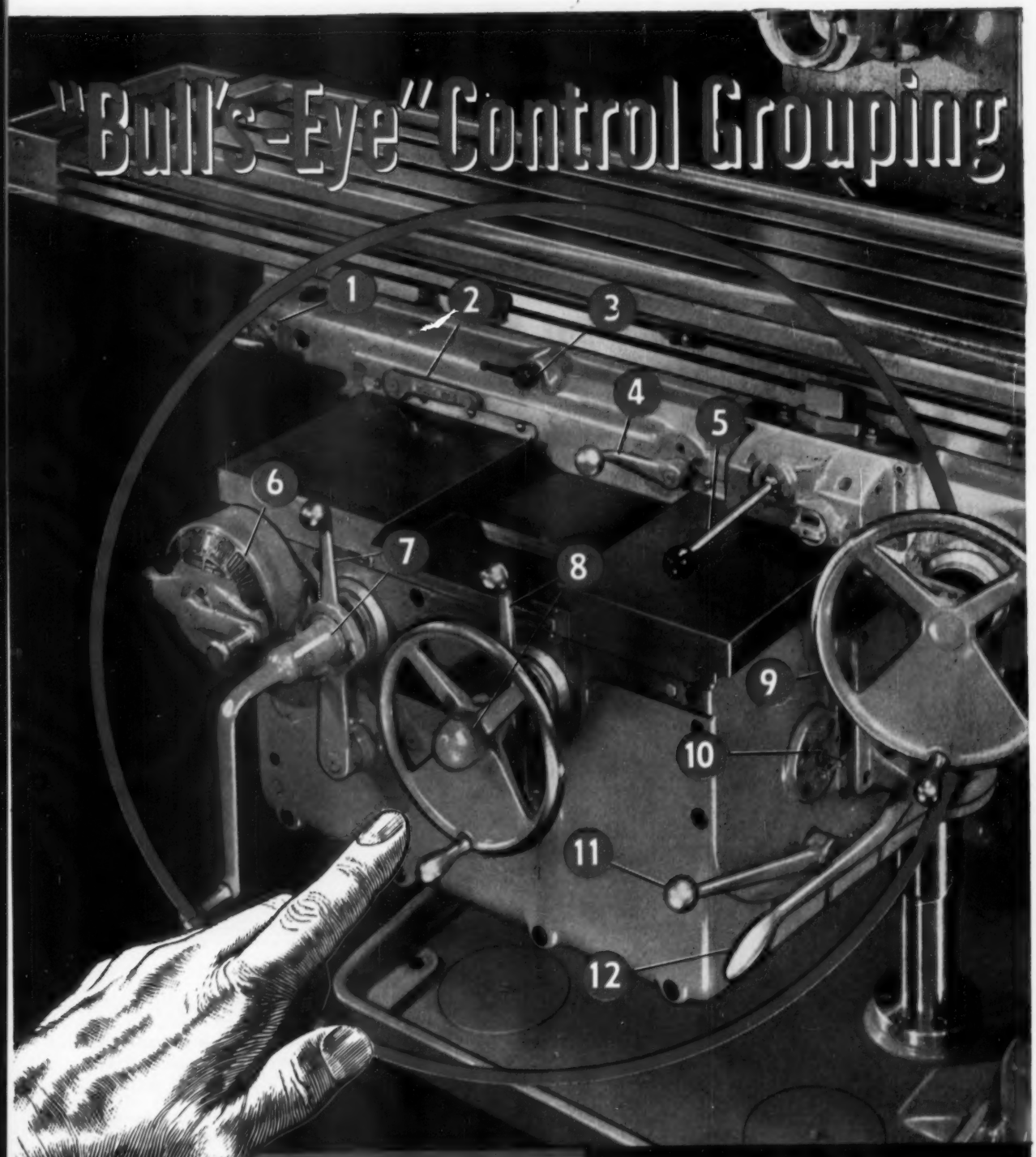
Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, flywheel, train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life and quieter operation.

KEARNEY & TRECKER CORP.
6786 W. National Avenue, Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on the new line of TF Series Plain, Universal and Vertical milling machines.

Name.....
Title.....
Company.....
Address.....
City.....Zone.....State.....

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, and permits easy access for routine maintenance.



FRONT-MOUNTED CONTROLS

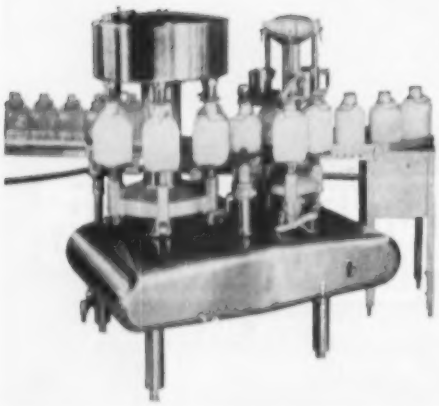
1—Single shot saddle-table and mechanism way lubricator
2—Backlash eliminator
3—Table clamp
4—Adjustable saddle clamping gib
5—Mono-Lever and Automatic Cycle Table Control
6—Quick change feed selector
7—Hand and power knee controls
8—Hand and power saddle controls
9—Front-mounted table handwheel
10—Knee lubrication filter
11—Spindle "start-stop"
12—Rapid traverse control—knee, table and saddle.

KEARNEY & TRECKER
MILWAUKEE

BUILDERS OF PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

NEW WARNER & SWASEY

New Warner & Swasey No. 4 Turret Lathe for machining stainless steel dairy equipment components (shown at right) at Federal Mfg. Co., Milwaukee, Wisc.



SPECIALIST PRODUCER of milk bottle filling and capping machines, Milwaukee's Federal Mfg. Co.—a small, but most progressive organization—is today enjoying a phenomenal growth. This is due to the dairy industry's enthusiastic acceptance of their new and unique 'Vacu-Matic' filling machines.

PROBLEM—Precision components of these machines—produced in average lots, ranging from 100 to 300 pieces—are of 303 stainless steel. Required machining tolerances were .0005", and surface finishes of 40 micro-inches had to be held in order to keep subsequent polishing costs to a minimum.

SOLUTION—Federal's new Warner & Swasey No. 4 Ram Type Turret Lathe adequately meets the desired accuracy and surface finish specifications—and, in addition, has increased production three times above rates obtainable on their older turret lathes.

YOU CAN PRODUCE IT BETTER,

HOLDS .0005" ACCURACY...

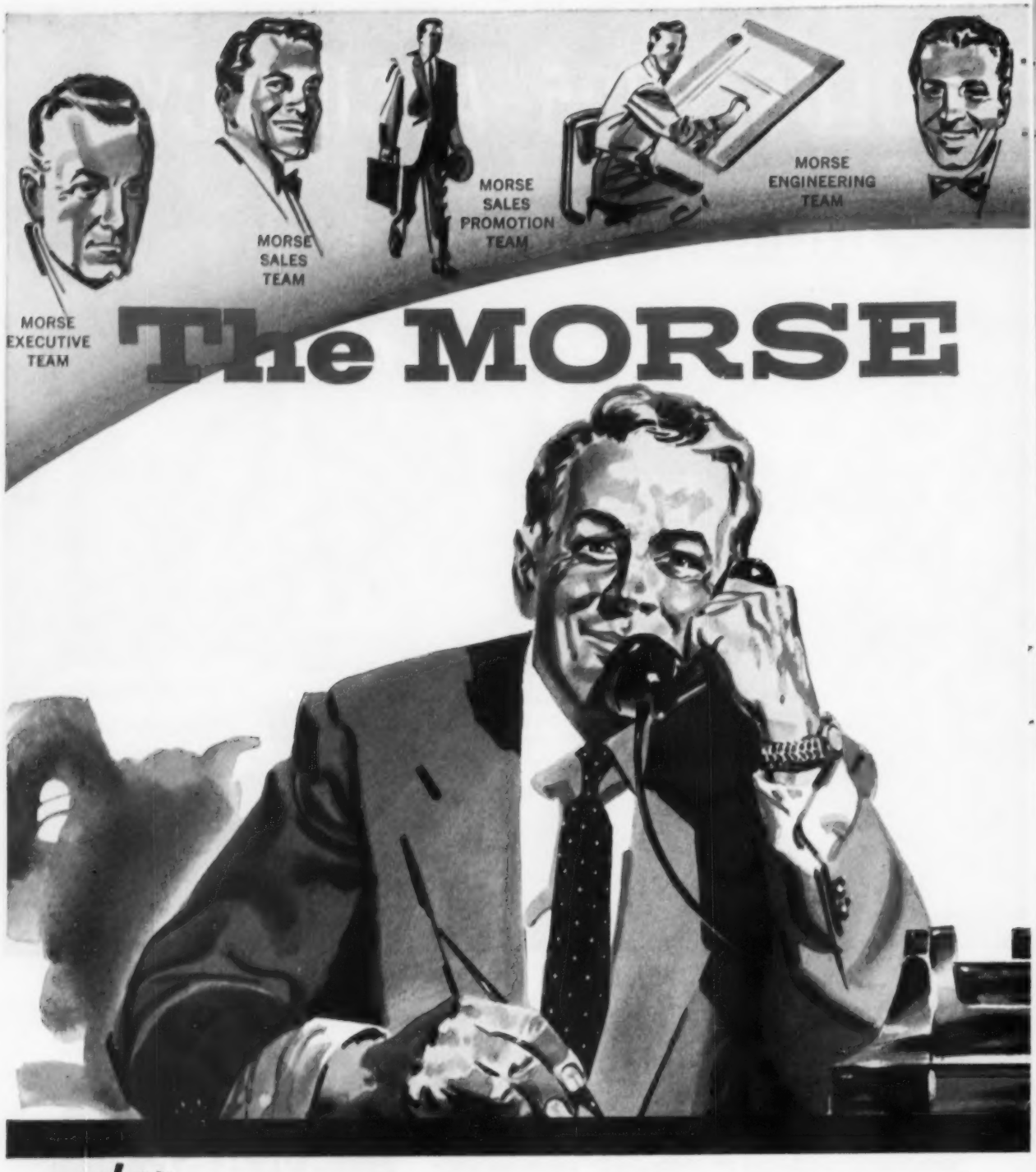
triples production rate for Federal Mfg. Co.

OPERATOR REPORTS—"Ease of machine handling made possible our sizable production increase. We make full use of the lathe's 6 to 1 high-low shift and two-speed motor which instantly and effortlessly provide a choice of four speeds without preselection—a time-saver for changing speeds from turn, to ream, to cut off, etc. In all, our new No. 4 all-clutch hydraulic headstock, with its two-speed motor, provides a total of 24 *unduplicated* speeds—any of which can be preselected while under cut, and instantaneously thrown into action by the flip of a lever. We also like the higher speeds and the easier, faster handling of the apron controls."

This is the kind of production you can expect in your own shop when you replace older turret lathes with modern Warner & Swaseys. Call in our Field Representative to talk about specific applications in your shop.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

FASTER, FOR LESS... WITH A WARNER & SWASEY



Another Reason Why—MORSE

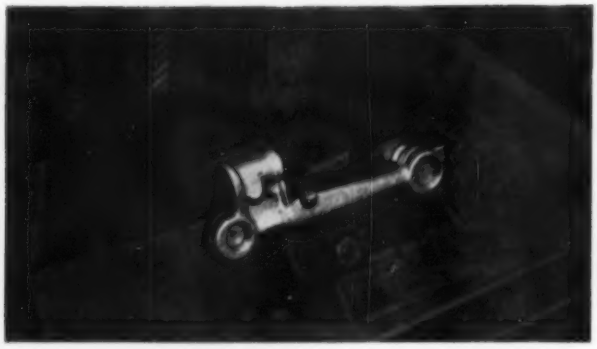
MORSE EXPEDITING TEAM
MORSE PRODUCTION TEAM
MORSE PRODUCT DEVELOPMENT TEAM
MORSE INVENTORY CONTROL TEAM
MORSE MACHINE DESIGN TEAM
MORSE TEAM OF CARBIDE TOOL SPECIALISTS

TEAM

...all Specialists
...all Backing Up your MORSE FRANCHISED DISTRIBUTOR

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASS.
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

means "THE MOST" in Cutting Tools



LAPOINTE -BROACHING by the ELECTRO-

This is an ideal broaching job for the Lapointe Double Ram Vertical Broaching Machine, **with electro-mechanical drive.** The machine is exceptionally heavy — 48,000 pounds — and can broach to very close tolerances and fine finish because of its weight and rigidity. (That means a big increase in tool life, too.)

LAPOINTE patented Tip-Down Fixtures permit maximum ease in loading. No bending, no reaching! The fixtures are automatic-clamping, hydraulically operated. Each ram is driven by a separate herringbone Bull Gear and Rack, eliminating any side thrust at broaching point. One ram broaches the right hand part, the other ram broaches the left hand part. No loss of time by the operator, because he loads one ram while the other is broaching.

With such efficiency, and a broaching speed of 40 feet-per-minute, it is not surprising that the actual production is one part every 12 seconds . . . 300 per hour!

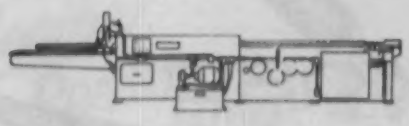
It's a good probability that you can lower your production costs by converting to Lapointe-Broaching. Why not ask a Lapointe Field Engineer to call on you?

THE LAPOINTE MACHINE TOOL COMPANY

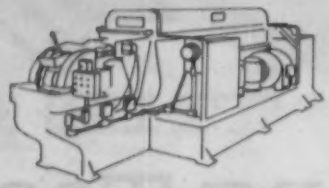
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

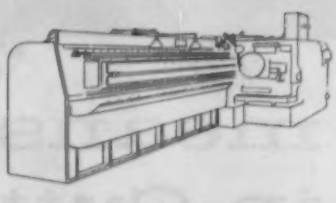
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC

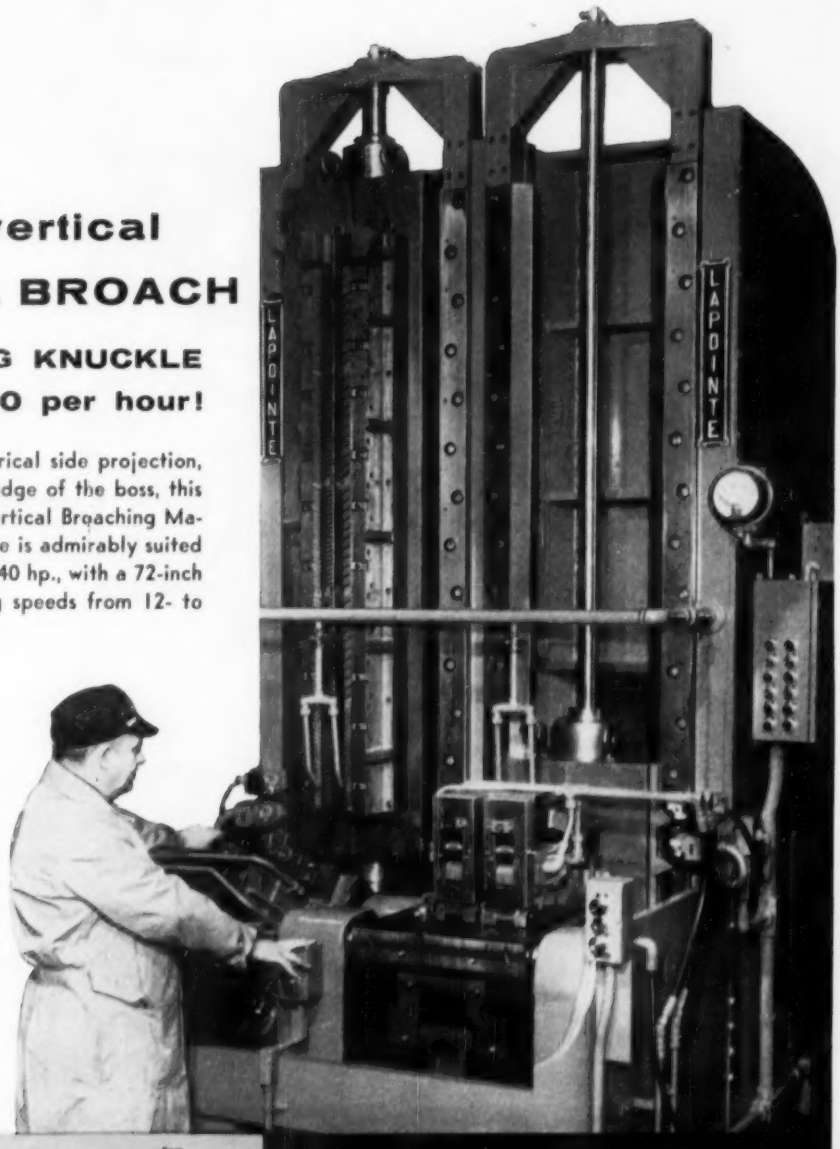


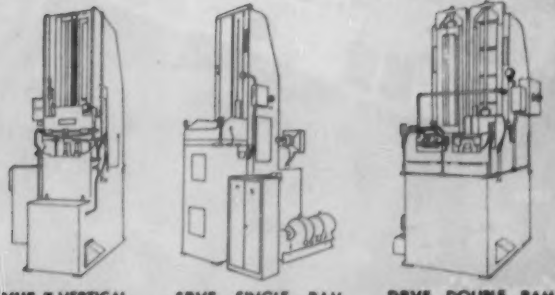
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

double ram vertical
MECHANICAL BROACH

produces STEERING KNUCKLE SUPPORTS . . . 300 per hour!

Broaching both ends of the cylindrical side projection, and broach-finishing the parallel edge of the boss, this LAPOINTE DRVE Double Ram Vertical Broaching Machine *with Electro-mechanical* Drive is admirably suited to this broaching application. It is 40 hp., with a 72-inch stroke, and offers variable cutting speeds from 12- to 75-feet-per-minute.





VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC

DRVE DOUBLE RAM VERTICAL, ELECTRIC

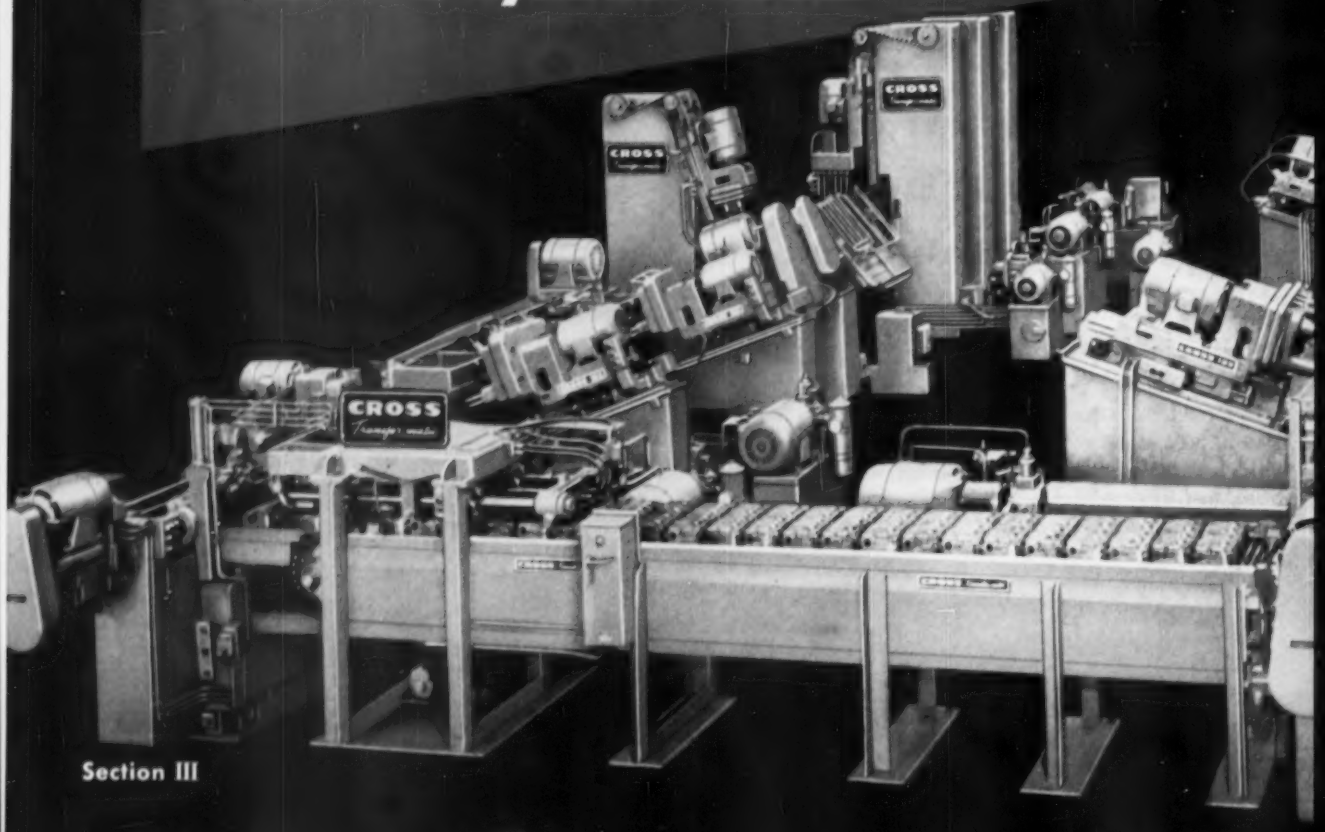
LAPOINTE

known to be the best in

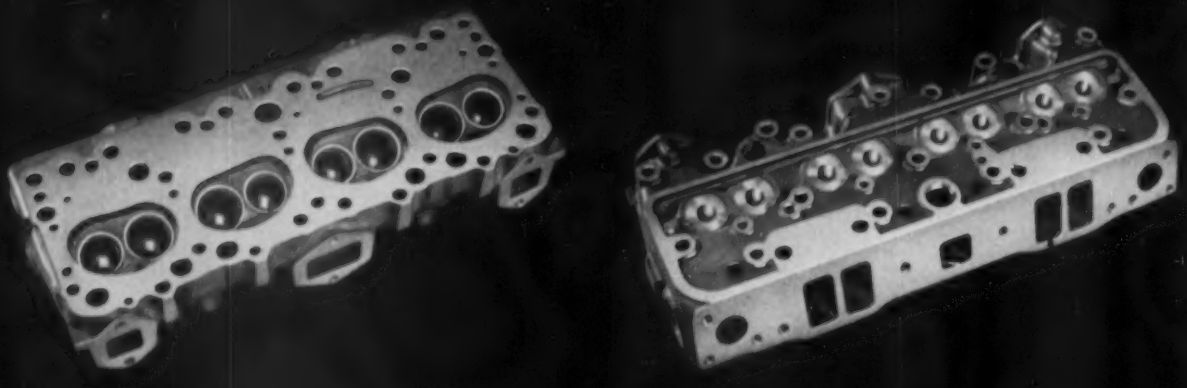
BROACHING

Introducing

Sectionized Automation with *Automatic Banking* for V-8 Cylinder Heads



Section III



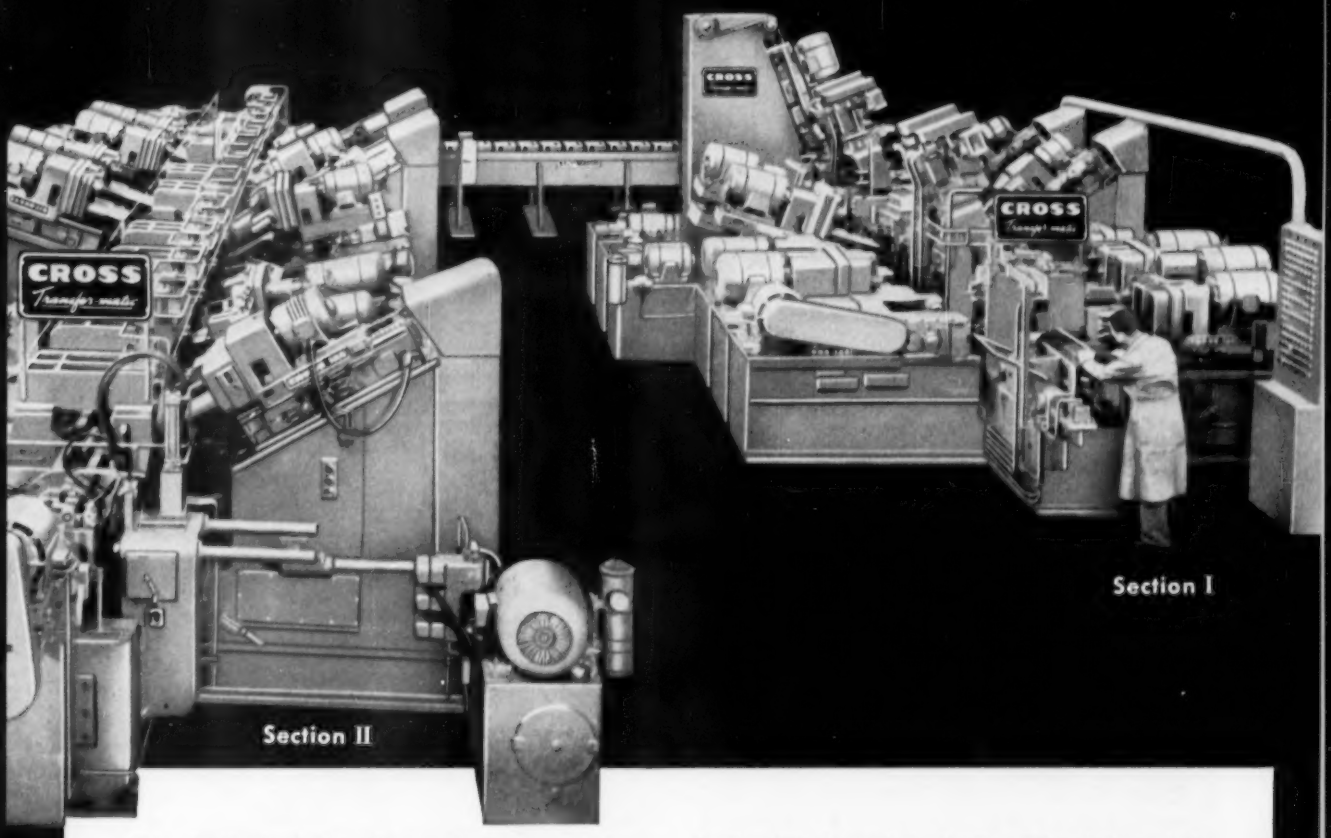
Established 1898

THE CROSS CO.

First in Automation

DETROIT 7, MICHIGAN

Another Automation First by Cross



This *Sectionized* Transfer-matic for machining V-8 cylinder heads is the first in the industry to utilize automatic banking to reduce downtime.

Key to the increased operating efficiency of this machine is its division into three sections and the use of two banking units—one at the rear between Sections I and II and the other in front between Sections II and III.

The first banking unit holds up to 35 pieces and feeds Section II. The second feeds Section III.

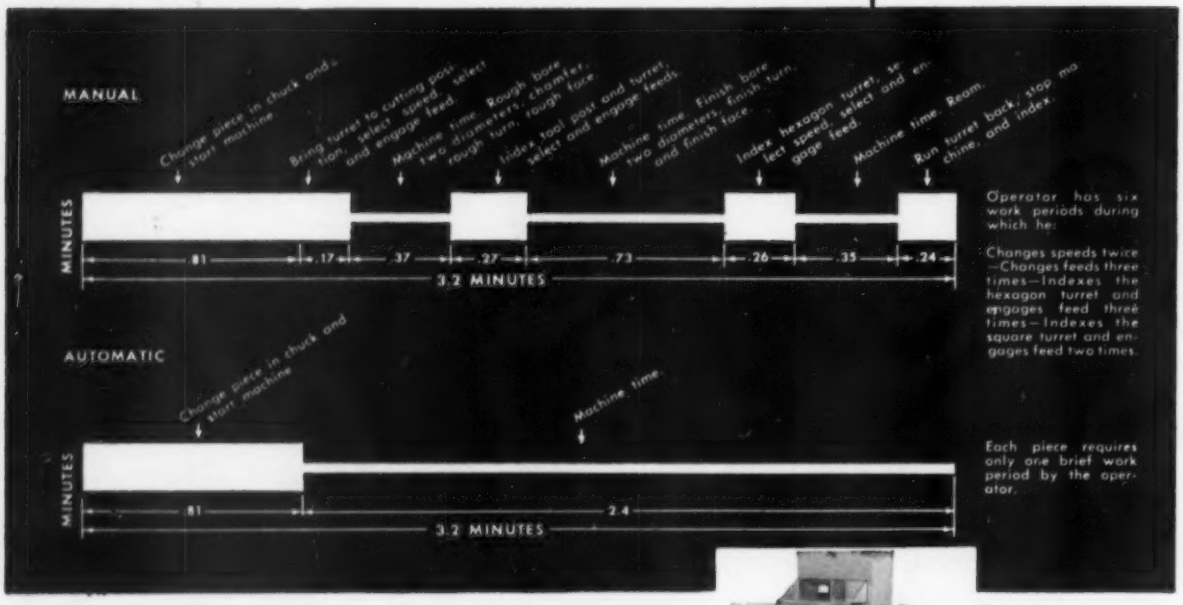
If production is interrupted in Section I for tool changing or maintenance, Sections II and III continue to operate as they receive parts from the two banking units. If Section II is stopped, the first banking unit stores the overflow from Section I and the second unit continues to feed Section III. If work in Section III is interrupted, the second banking unit receives and stores the parts from Sections I and II. The ability to shut down any one of the sections while the others continue to operate results in greatly increased production efficiency.

The entire line performs 461 operations on each of 144 cylinder heads per hour at 100% efficiency—213 in the 11 stations of Section I, 154 in the 16 stations of Section II and 94 in the 13 stations of Section III. This completes all operations except broaching.

Other features are: Construction to JIC standards, hardened and ground ways, automatic lubrication, automatic chip disposal, pre-set tooling throughout and Cross Machine Control Units to program tool changes.

how the GISHOLT FASTERMATIC saves man-minutes and money!

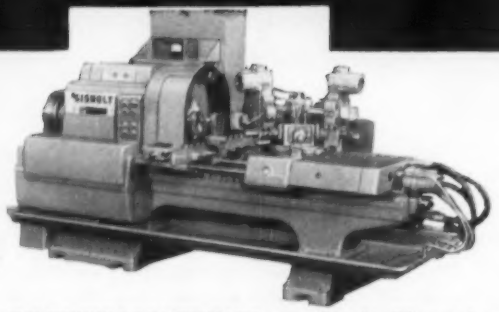
Here is an actual comparison of the time and work cycle of a manually operated turret lathe and a Gisholt Fastermatic Automatic Turret Lathe. The machining of wheel hubs, shown above, requires 6 operations as follows: rough bore, finish bore, ream, rough face, finish face and chamfer. Note that the manually operated machine takes over 54% of the operator's time whereas the Fastermatic takes only 25% of his time, leaving 75% without interruption.


MANUAL
Change piece in chuck and start machine
Bring turret to cutting position, select speed, select and engage feed
Machine time. Rough bore two diameters, chamfer, rough turn, rough face
Index tool post and turret, select and engage feeds
Machine time. Finish bore two diameters, finish turn, and finish face
Index hexagon turret, select speed, select and engage feed
Machine time. Ream.
Run turret back, stop machine, and index.
MINUTES
.81
.17
.37
.27
.73
.26
.35
.24
3.2 MINUTES
Operator has six work periods during which he:
Changes speeds twice—Changes feeds three times—Indexes the hexagon turret and engages feed three times—Indexes the square turret and engages feed two times.
AUTOMATIC
Change piece in chuck and start machine
Machine time
MINUTES
.81
2.4
3.2 MINUTES
Each piece requires only one brief work period by the operator.

That's the story of the Fastermatic in a nutshell—less work time for the operator. The Fastermatic handles all changes of feeds and speeds automatically.

In this case, for example, the other side of the work piece is done by another Fastermatic with substantially the same cycle. One operator keeps both machines constantly under cut and still has ample time for stacking and work inspection. Important, too, is the fact that both Fastermatics are tended by a comparatively unskilled operator.

There are many such cases where Fastermatics can cut costs substantially. Gisholt engineers will gladly answer your questions. Write us.



THE GISHOLT 1-F FASTERMATIC—*smallest of 3 different sizes which enable you to machine a maximum number of surfaces in one chucking, handling all changes in speed and feed automatically. On this job, turret was double-tooled so that two parts were completed with each revolution of the turret. Ask for literature.*

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

GISHOLT

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

"Tumblex* 'T' has a definite place in our tumbling department"...

Leading pump manufacturer lists benefits gained from Norton ALUNDUM TUMBLEX 'T' abrasive*

The executive we're quoting based his decision on parts difficult to deburr with his previous tumbling abrasive. Test runs with Tumblex "T" abrasive, the new Norton bonded, triangular shaped tumbling abrasive, gave him these results:

Part A — 100% increase in barrel payload and 80% reduction in tumbling time. A sandblast operation eliminated and hand deburring reduced about 75%.

Part B — Barrel production increased 20%, tumbling time reduced 25%.

Part C — Barrel production increased 25%, tumbling time reduced 50%.

Part D — Sixteen hours hand deburring saved per 1000 parts.

Tumblex "T" abrasive is one of the most revolutionary tumbling abrasives ever developed. Everything about it is designed for better barrel finishing.

Its uniform triangular shape and size prevents wedging in recesses . . . Made of famous bonded ALUNDUM abrasive, it cuts fast, with no cutting compound needed . . . It provides maximum surface contact with parts being processed, for shorter cycles and larger payloads . . . It wears evenly, and when worn down can be used on parts requiring a smaller abrasive . . . Its lightness means less weight required to fill the barrel.

Results are more uniform finish, shorter time cycles and lower costs per piece finished.

Send For Work Samples

to our Sample Processing Department. Let us prove to you how the latest barrel finishing equipment and techniques can add the "Touch of Gold" that improves product quality and cuts finishing time and costs. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

G-315

TUMBLEX "T" ABRASIVE brings three big advantages to barrel-finishing: non-wedging triangular shape; fast-cutting bonded ALUNDUM abrasive; long, even wear. Especially effective on intricate-shaped parts. Available in four sizes.

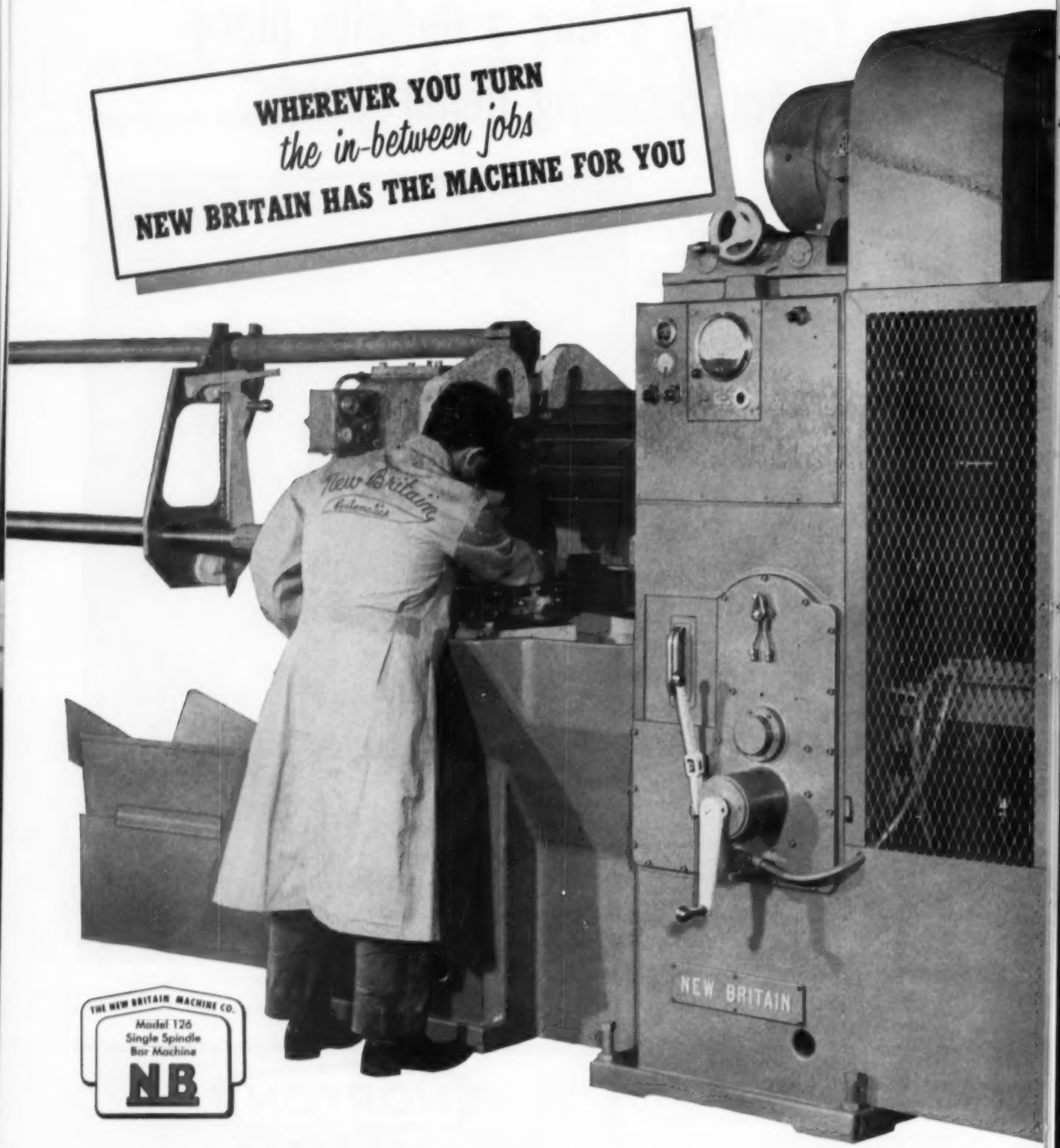
NORTON
ABRASIVES

Making better products...to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

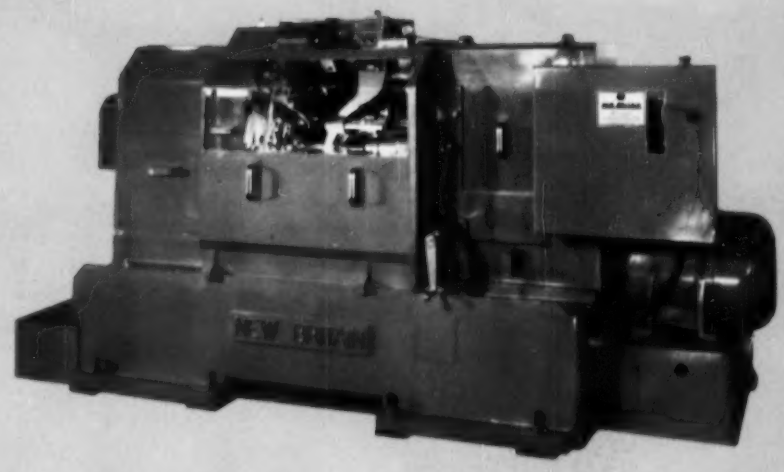
WHEREVER YOU TURN
the in-between jobs
NEW BRITAIN HAS THE MACHINE FOR YOU



In the big borderline area of production between hand screw machines and multiple spindle types, the Model 126 New Britain single spindle bar machine can make money for you. It's rugged, fast and highly accurate. It requires minimum set-up time for tool changes, cross slide cam settings and positioning of operational sequences on the central program drum. Capacity 2⅝". May we mail you more details?

WHEREVER YOU TURN
on multi-spindle bar machines
NEW BRITAIN HAS THE MACHINE FOR YOU

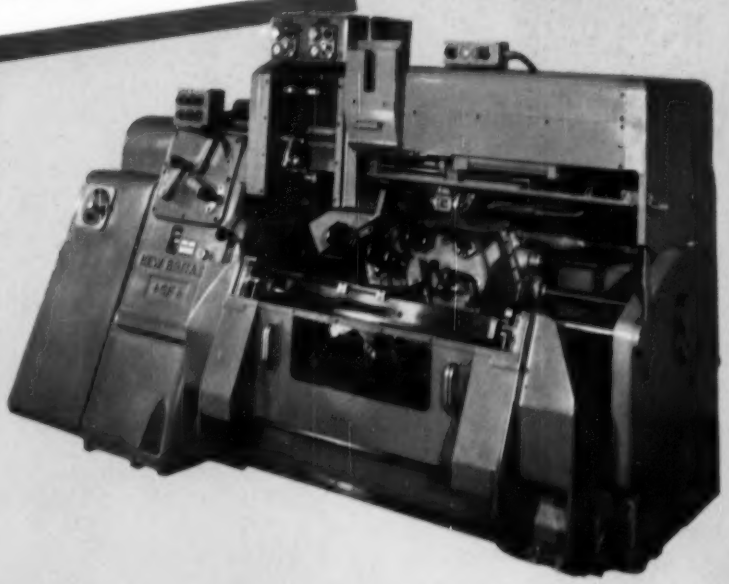
THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB



The new Model 62 New Britain bar machine has an independent radial cross slide in every position — opening new possibilities for effective tooling. New Britain "accuracy features" include spindle carrier lifting to eliminate wear during index, plus rigid locking of the carrier during the cutting cycle. Magazine loading available if desired.

WHEREVER YOU TURN
long or short runs
NEW BRITAIN HAS THE MACHINE FOR YOU

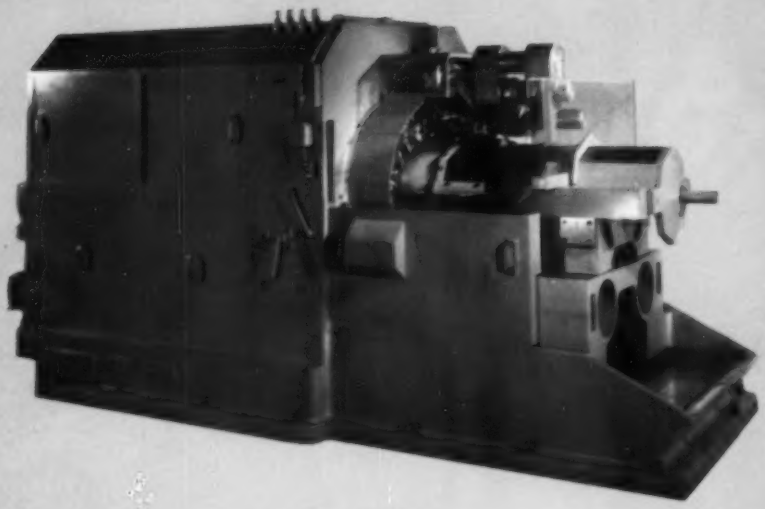
THE NEW BRITAIN MACHINE CO.
Model 11/70
New Britain +GF+
Copying Lathe
NB



The original New Britain **+GF+** copying lathe has grown into an extensive line, to meet the demand for the wide variety of applications for its better copy-turning principle. Regardless of length of run or the variety of pieces you make, you can use the New Britain **+GF+** profitably. Basic advantages are: fast setup, inexpensive tooling, elimination of the chip problem, minimum operator fatigue, and dimensional accuracy with good surface finish to reduce grinding allowances. Optional features include automatic re-cycling, automatic loading and ejecting.

WHEREVER YOU TURN
castings, forgings or pressed metal pieces
NEW BRITAIN HAS THE MACHINE FOR YOU

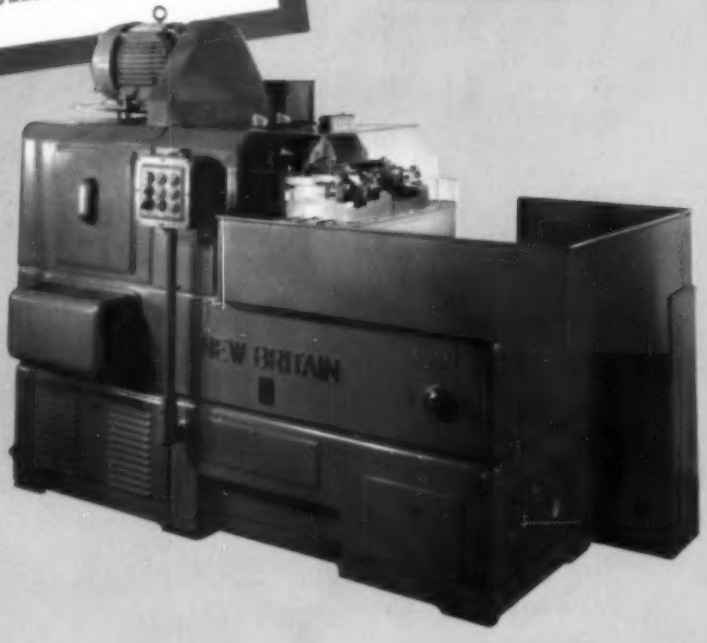
THE NEW BRITAIN MACHINE CO.
Model 810
Automatic
Chucking Machine
NB



Versatility, accessibility, quick setup and sustained high production of precision parts are what you look for in an automatic chucker. New Britains are famous for these features all over the world. Perhaps you are also thinking of the possible savings which automatic loading, unloading and automatic gauging could effect. If so, you will want to learn about the imaginative use of automated production which New Britain engineers are applying to chucker work these days. You can now handle bigger pieces than ever on New Britains too — up to fifteen inches in diameter.

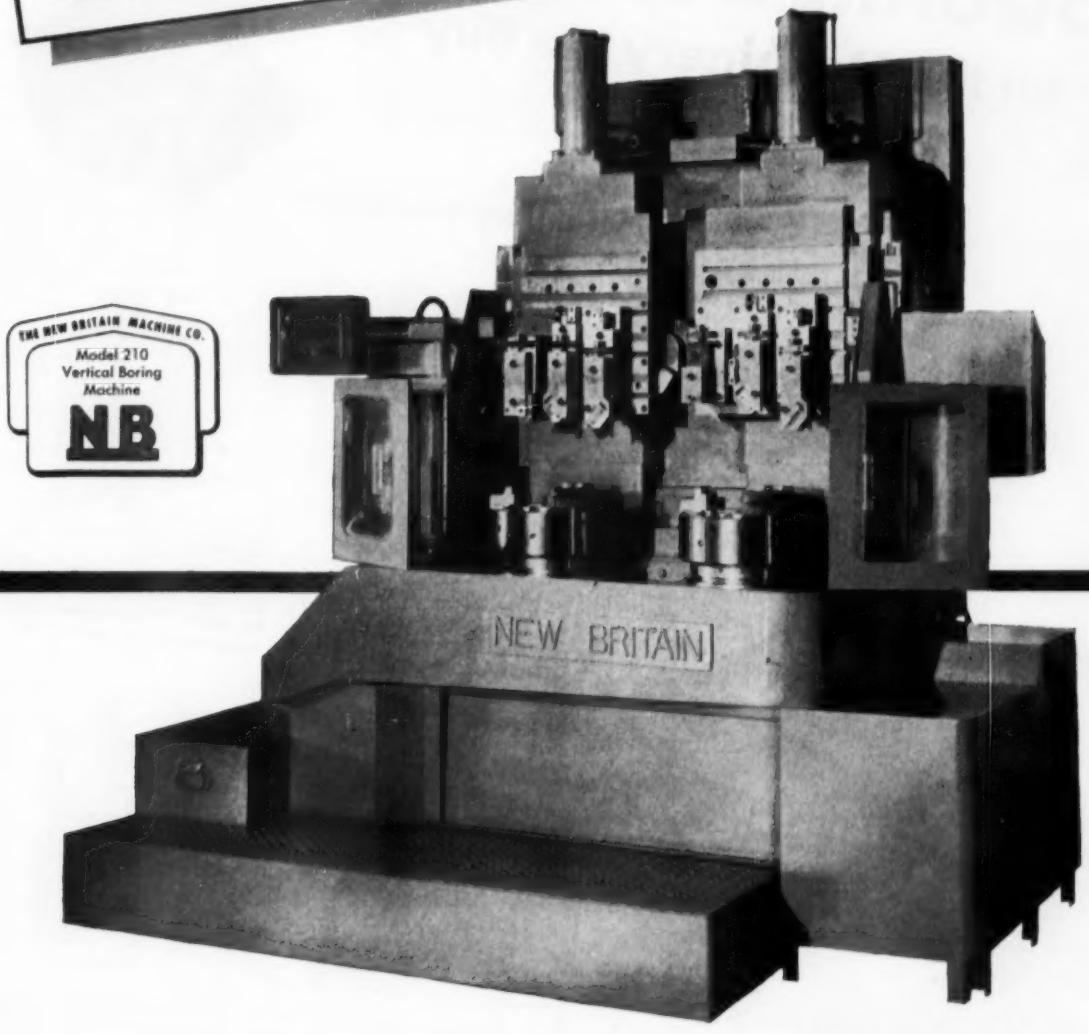
WHEREVER YOU TURN
or bore precision contour work
NEW BRITAIN HAS THE MACHINE FOR YOU

THE NEW BRITAIN MACHINE CO.
Model 37
Precision Boring
Machine
NB



New Britain precision straight and contour boring machines provide a new approach to machining parts that would be problem pieces on any other type of equipment. These simple, fast, accurate machines require minimum attention and utilize inexpensive single point tools. They make the most profitable use of automatic loading, gauging and tool adjustment where these features fit the job requirements. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

WHEREVER YOU TURN
or bore large, heavy pieces
NEW BRITAIN HAS THE MACHINE FOR YOU



Accurate cam control of tool paths is the essential to precision contour boring. The Model 210 New Britain precision *vertical* boring machine extends the speed, accuracy and fine finish of precision straight and contour boring and turning to a wider variety of work pieces. Perhaps this is the answer to excessive costs on some of *your* work.

NEW BRITAIN-GRIDLEY MACHINE DIVISION

The New Britain Machine Company • New Britain, Connecticut

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS

LUCAS MACHINE DIVISION
Cleveland, Ohio
Precision Horizontal Boring, Drilling and Milling Machines

HOERN & DILTS DIVISION
Saginaw, Michigan
Multiple Spindle Precision Finishing Machines

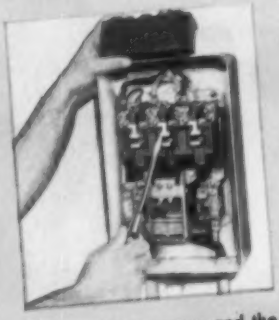
Here's Why We Specify
SQUARE D Starters
on the Machinery We Buy

PERFORMANCE, EASY INSPECTION AND MAINTENANCE

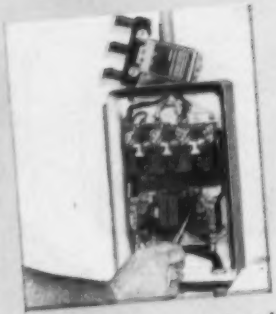
Sure, we like Square D performance because it keeps our "down time" at a minimum. BUT—everybody knows that even the best starter needs periodic inspection and preventive maintenance. We like the way Square D makes it easy to handle those routine jobs.

OFF-THE-SHELF PARTS KITS

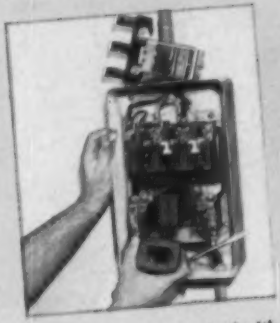
They make normal maintenance and modifications easier than ever. Packaged parts include interlocks, contacts, coils, overload relays, pushbuttons and selector switches. They're easy to buy, easy to identify, and faster to install.



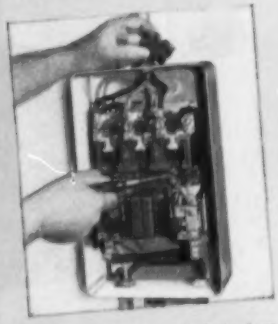
1 Loosen two screws and the arc chamber cover comes off. Every contact surface can be inspected at a glance.



2 Remove four screws and entire movable assembly can be lifted off. Disconnect two wires and slip off magnet coil.



3 Contacts are attached with separate screws—they can be removed and replaced without disturbing any wiring. A screwdriver is the only tool needed.



4 Sizes 0 through 4 starters have these separate mounting electrical interlocks for easier installation. Contact block is attached from front of panel with two screws.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

THREADWELL'S New
TAP PRIMER
—for the newcomer to the metalworking field an introduction to the science of tapping explained in simple terms.
—for the old hand, a convenient refresher and reference.
Get your copy now.

THREADWELL TAP & DIE CO.
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I'd like .....copies of the new Tap Primer.

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C

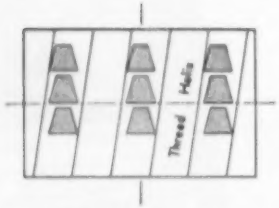
BARBER-COLMAN offers

thread milling requires accurate cutter design!

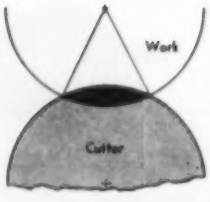
mathematical computation of cutter form

Multiple thread milling cutters often produce a thread space form which is not a duplicate of the cutter tooth form. The cutter tooth form is not a duplicate because the cutter tooth rotates in a plane which is perpendicular to the work axis and at an angle to the thread helix. This generating action produces a fillet at the bottom of the threads, and a thread space which is wider than the cutter tooth. When the amount of generating produces an unsatisfactory thread form, the cutter must be developed to produce the desired thread tooth thickness without fillet interference.

Whenever required, Barber-Colman engineers, by mathematical computation, design the correct cutter which compensates for the generating action. In this computation, the diameter of the cutter is very important since the amount of tooth form correction increases as the diameter of the cutter increases. A thread produced by a specially-developed cutter will have an accurate form which will fit the gage with the desired bearing.



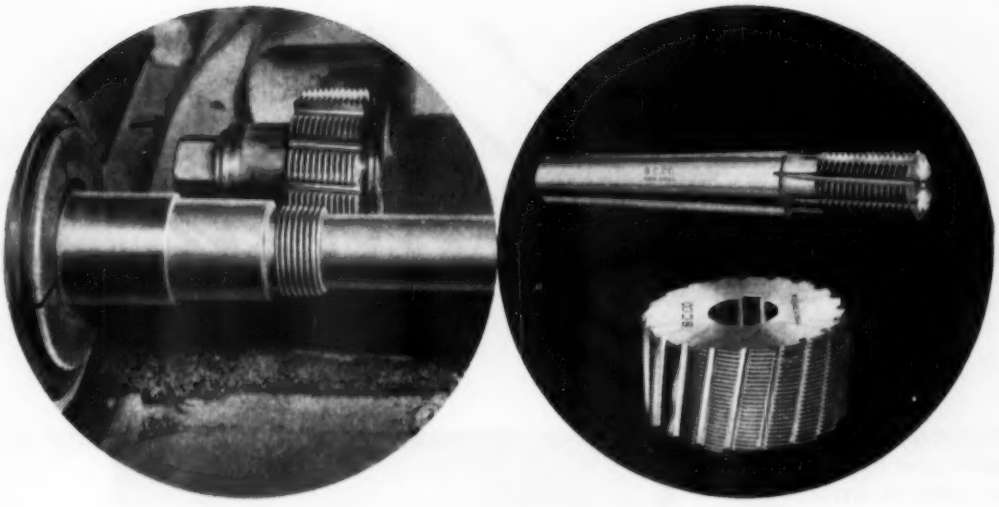
This schematic drawing shows how a multiple thread milling cutter produces a thread space which is wider than the cutter tooth. The cutter is set so that the plane of rotation of the cutter teeth is perpendicular to the work axis, and at an angle to the thread helix.



Large diameter cutters have greater length of contact and produce more pronounced fillets.

Small diameter cutters have less length of contact and produce smaller fillets.

In some cases, cutters mill deeper than true thread form. Any generated fillets which may be cut are then below the gaging surface of the thread. Correct cutter design takes care of this automatically.



original cutter accuracy in resharpening

All Barber-Colman form-relieved milling cutters are accurately index-sharpened on Barber-Colman automatic sharpening machines, so that all cutter teeth are the same height and accurately spaced. This makes it easy to maintain original cutter accuracy when resharpening either on automatic sharpeners, or on conventional sharpening equipment using the accurately indexed cutter teeth as a reference. In either case, accurate sharpening to original tolerances is easily maintained, and cutter sharpening time is reduced to a minimum.

design elements for maximum performance

With the proper tooth form developed to cut accurate threads, the engineers then analyze the job conditions to determine which cutter features will produce best cutter performance. These features include selection of the proper cutter material, shell or shank type cutters, straight or helical flutes, rake teeth, axial relief and intermittent teeth if sharp threads are desired. Since we make all classes of ground and unground thread milling cutters, we can recommend the cutter accuracy required for your job.

When you have a threading problem, consult Barber-Colman cutter engineers for their recommendations on the proper cutters for the job. Be sure the cutters you have are accurately designed to cut the correct thread form. Send us blueprints of your threaded parts for quotation on thread milling cutters designed to produce correct threads.

BARBER-COLMAN COMPANY

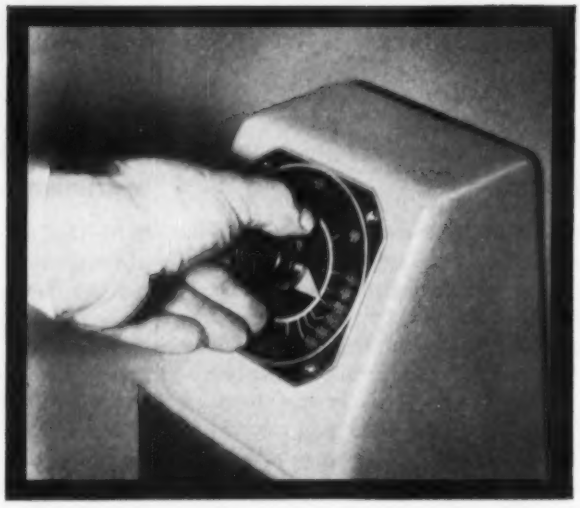
8110 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

Hendey

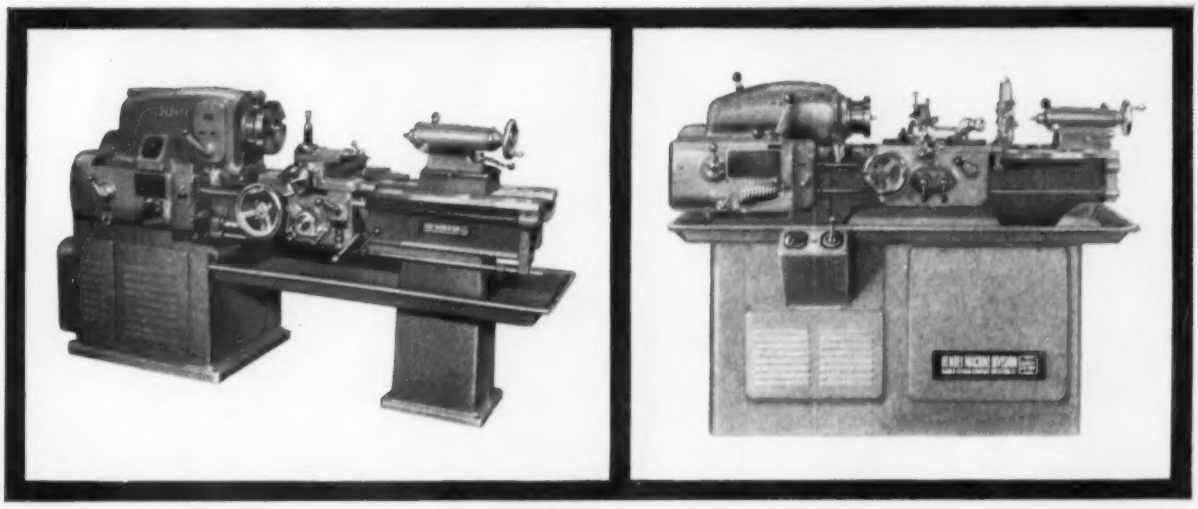
Now, Hendey stepless speed control makes other types of drives as old-fashioned as overhead belts! Your lathes can't turn a profit while they are coasting to a stop to change speeds. The Hendey speed control unit allows a wide range of stepless speed control and a close control of speed under a changing load. Speeds may be changed smoothly while the spindle is under load. An instantaneous electric dynamic brake is provided for rapid stopping and reversing of the spindle. Starting, stopping, and reversing of the spindle from preset speeds are accomplished smoothly and rapidly. Send for descriptive bulletin.



for precision <u>with</u> production, buy Hendey

STEPLESS SPEED CONTROL

BOOSTS PROFITS IN YOUR TOOLROOM OR SHOP



General-Purpose Lathe No. 2E, 14 in.

Smooth, vibration-free belt-driven spindle speeds from 15 to 1500 rpm . . . stepless control of speeds permits smooth change even under load . . . dynamic brake on spindle . . . convenient controls . . . preloaded precision spindle bearings.

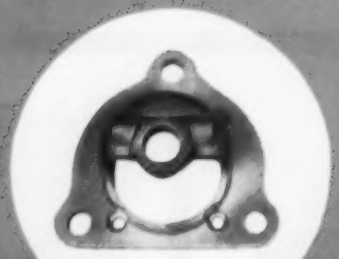
Tool and Gage-maker Lathe, 9 in. by 24 in.

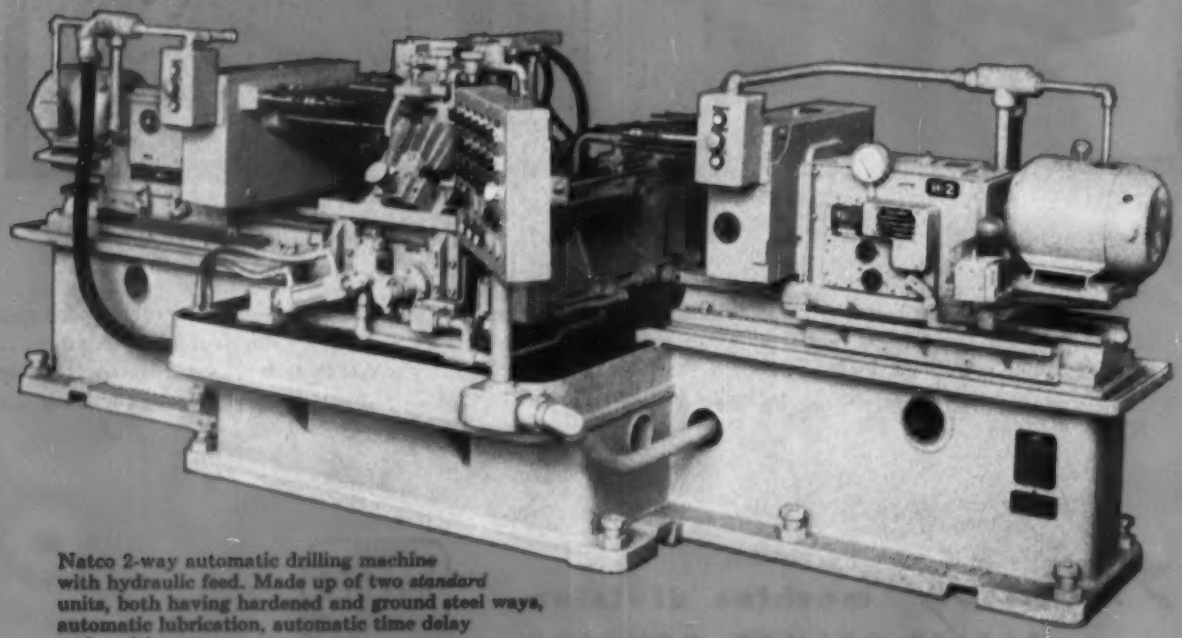
Infinitely variable spindle speeds from 15 to 3000 rpm with magnetic amplifier drive or electronic drive system . . . simplified, convenient controls . . . change speeds smoothly under load . . . dynamic brake stops spindle instantly. . . precision craftsmanship throughout.

Hendey **machine division**
BARBER-COLMAN COMPANY
1018 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN

Natco Standard Units Perform Special Jobs

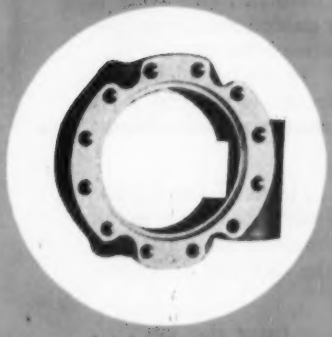


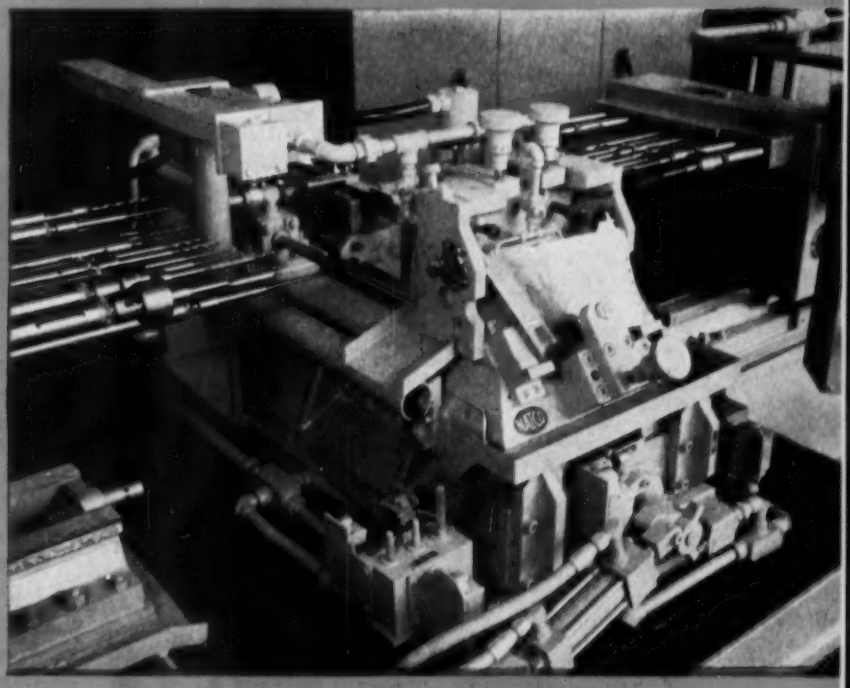


Natco 2-way automatic drilling machine with hydraulic feed. Made up of two *standard* units, both having hardened and ground steel ways, automatic lubrication, automatic time delay and positive stop.

Many *special* jobs can become routine with Natco's *standard* unit design. Take these parts, for instance. Unique parts presenting unique problems. Natco solved them by using *standard* horizontal, self-contained Holeunits with automatic fixtures. Varied operations are performed—production to meet customer's requirements.

Natco's use of *standard* units can mean quicker delivery and lower price to you. Call a Natco Field Engineer to determine whether Natco's *standard* unit design can solve your "special" problems.





Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

NATIONAL AUTOMATIC TOOL COMPANY, INC.

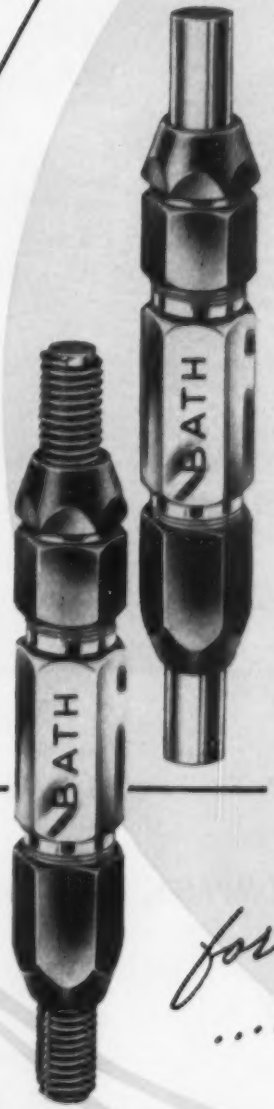
Richmond, Indiana

NATCO

Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production.

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

*Controlled Measure....



A roar . . . a flash . . . and away it goes! Another guided missile streaks into space, dependent on the performance of sensitive electronic equipment. Precision is vital . . . components must function without fail.

Bath Gages . . . tools of the science of **controlled measure* . . . are made to check the limits of these intricate parts . . . on the line and at inspection centers.

No matter how fussy the job . . . cylindrical plug or thread, ring or reversible type Bath Gages are designed for accuracy and long wear-life.

Remember . . . when you buy Bath Gages . . . you buy **controlled measure* for threaded and plain parts and holes.

for the best buy ...buy Bath

JOHN BATH & CO., Inc.
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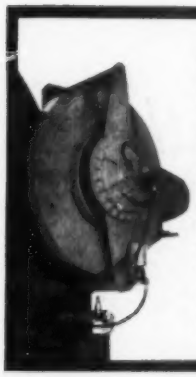
CYLINDRICAL AND THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS



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Single-unit design eliminates "overlap" between clutch and brake . . . provides extremely smooth jogging or complete cycle operation . . . no adjustment required through life of friction material.

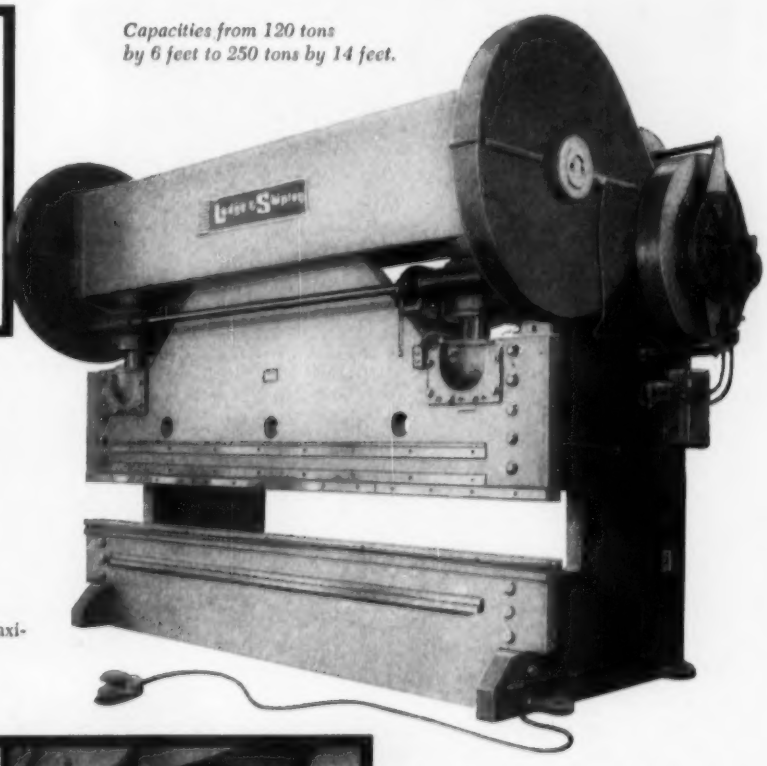
Only LODGE & SHIPLEY GIVES YOU ALL OF THESE DESIRABLE PRESS BRAKE FEATURES

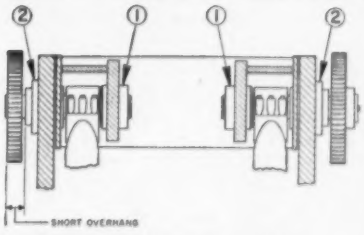
Patented wedge-type ram pressure release

WEDGE-TYPE RAM PRESSURE RELEASE

No need to dismantle machine or to burn out die holder if dies are stuck. Ram Pressure Release quickly releases pressure due to improper die adjustment.

Capacities from 120 tons by 6 feet to 250 tons by 14 feet.



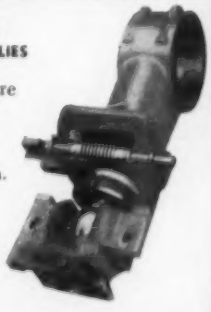


SUPERIOR ECCENTRIC SHAFT SUPPORT

Each eccentric has two full bearings for maximum support of pittmans and drive gears.

EXTRA STRENGTH PITTMAN ASSEMBLIES

Pittman screws are provided with fine modified buttress threads for extra strength. Rotating nuts provide adjustment without rotating pittman screws.



MOTOR-OPERATED MICROMETER RAM ADJUSTMENT

A separate out-of-the-way motor provides means of adjusting ram out of parallel for irregularities in dies or fade-out operations.

These production-proved features contribute importantly to time, labor and cost savings. Check them against any other brake . . . see the superiority of Lodge & Shipley Press Brakes. Write for new FREE Bulletin PB-5 and the name of your nearest distributor. The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio.

OTHER FEATURES:

- One-piece Forged Alloy Eccentric Shafts
- Rugged Solid Steel Housing
- Housing Supported Base
- Rugged Drive
- Full Length Slide Bearings
- Full Length Gibs on Slide Bearings
- Positive Lubrication System
- Convenient Hand and Foot Controls

In brakes and shears, too . . . your Lodge-ical Choice is

Lodge & Shipley

the finest high speed lathes

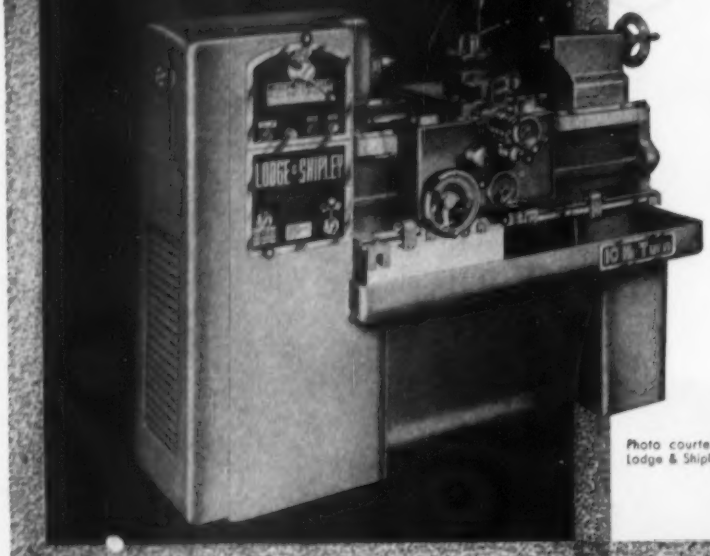
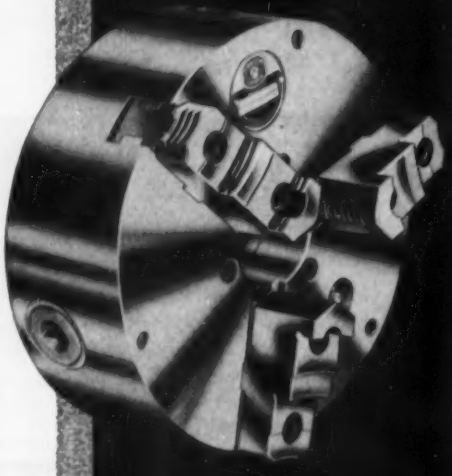


Photo courtesy Lodge & Shipley

This is the NEW Lodge & Shipley 10" Hi • Turn Lathe which joins the line famous for lathe leadership. It provides high speed turning, boring and facing capacity for production departments. For complete information, write for Bulletin 300, The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

deserve the finest precision chucks

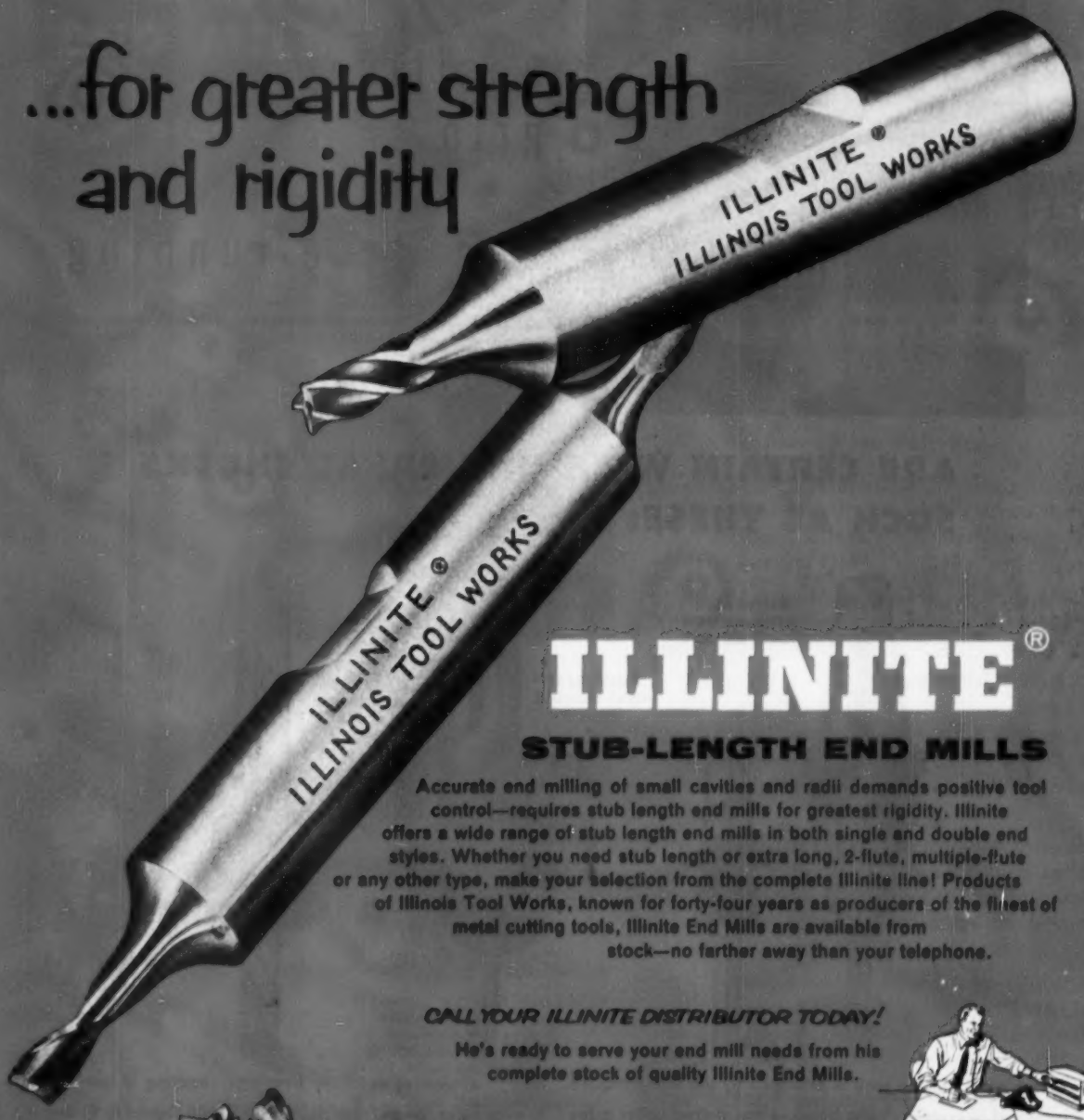


This is Horton's 3-Jaw Scroll Universal Chuck which for over 100 years has been the ideal complement to the world's finest tool room, general purpose and production lathes. Its precision and lasting accuracy make it a part of any production picture. For the complete story on this and Horton's complete line of precision chucks, see the Horton people in your area now.

HORTON
Since 1851
CHUCK

WINDSOR LOCKS, CONN.

...for greater strength and rigidity



ILLINITE®

STUB-LENGTH END MILLS

Accurate end milling of small cavities and radii demands positive tool control—requires stub length end mills for greatest rigidity. Illinite offers a wide range of stub length end mills in both single and double end styles. Whether you need stub length or extra long, 2-flute, multiple-flute or any other type, make your selection from the complete Illinite line! Products of Illinois Tool Works, known for forty-four years as producers of the finest of metal cutting tools, Illinite End Mills are available from stock—no farther away than your telephone.

CALL YOUR ILLINITE DISTRIBUTOR TODAY!

He's ready to serve your end mill needs from his complete stock of quality Illinite End Mills.

NOW!

...Special Form-Relieved Milling Cutters available through your local Illinite Distributor

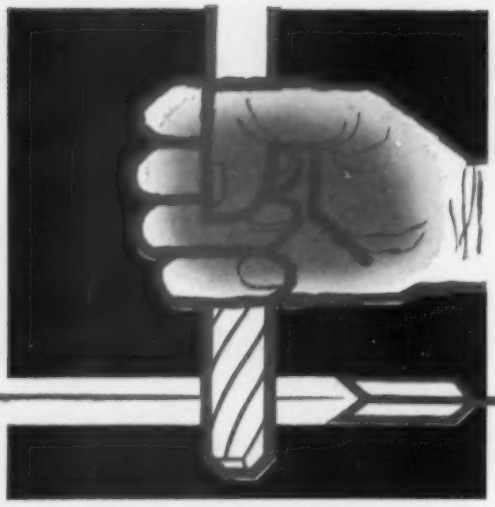
THE QUALITY LINE FROM...

ILLINOIS TOOL WORKS

2501 N. Keeler Avenue
Chicago 39, Illinois

ILLINITE...the most complete line of Standard Metal Cutting Tools—available from stock!

TRI-MILS • END MILLS • MILLING CUTTERS
SLITTING SAWS • KEYSLOT CUTTERS • HOBS
SHAPER CUTTERS • TOOL BITS

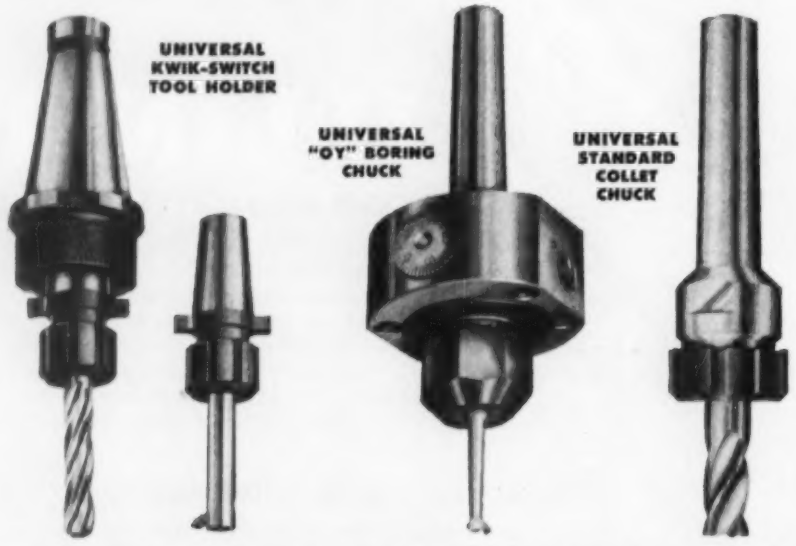


positive
grip

and true-running

tools

ARE CERTAIN WITH UNIVERSAL CHUCKS SUCH AS THESE:



A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. This positive grip, plus the precision manufacturing of all Universal chucks, keeps tools running true to .001" within an inch from the nose of the chuck. Our simplified chuck design eliminates auxiliary begrings, resulting in low cost to you. Sizes range from 1/16" to 1 1/2", with shanks to fit any machine. For complete information on these three or other Universal chucks, write the office nearest you: Universal Engineering Sales Co., 1060 Broad St., Newark, N. J., 5053 Sixth Ave., Kenosha, Wis., or our home office in Frankenmuth.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 1, MICHIGAN

195

DoALL END MILLS
High Speed Steel

Choose From Over 250 Different End Mills In Local Stocks

Many "Specials" At Standard Prices . . .
Immediate Delivery

High speed steel end mills featuring a double back-off design are available from local DoALL stock in *over 250 different combinations of size and type!*

For instance, the following end mills which are premium price specials at many places, are standard at DoALL:

Long 2 flute single end; double ball end; shank type dovetail cutters; 2" dia., 2 shank—3, 4, or 6 flutes; straight shank T-slot cutters; left hand spiral, right hand cut; stub flute.

All DoALL end mills are completely finish ground after hardening, have a high helix angle which promotes smoother cutting, and have hollow ground spiral flutes for better chip removal and less abrasive action.

. . . And, when you need a special end mill not carried in stock, you'll find DoALL has the fastest delivery! Call your local DoALL Sales-Service Store today, or write:

The DoALL Company, Des Plaines, Illinois

- Taps
- Reamers
- Tool Bits
- Twist Drills
- Countersinks
- Milling Cutters
- Carbides

All types of high speed steel end mills and cutting tools stocked locally.

FREE CATALOG B4a — lists complete line of H.S. Steel end mills with complete specifications and prices. Write for it today!

CT-19

FRIENDLY DoALL STORES IN 38 CITIES give you personalized service and local delivery from complete stocks

TAPS • DIES • SCREW PLATES • GAGES

GAGES by Card

TAPS by Card

The CARD Quality

Behind the manufacture of Card gages is specialized experience for over 80 years in producing the world-famous Card line of precision taps and dies. When you specify Taps, Dies or Gages by Card, you can be certain that you'll get top performance at low cost.

Presenting the Symbol of Service

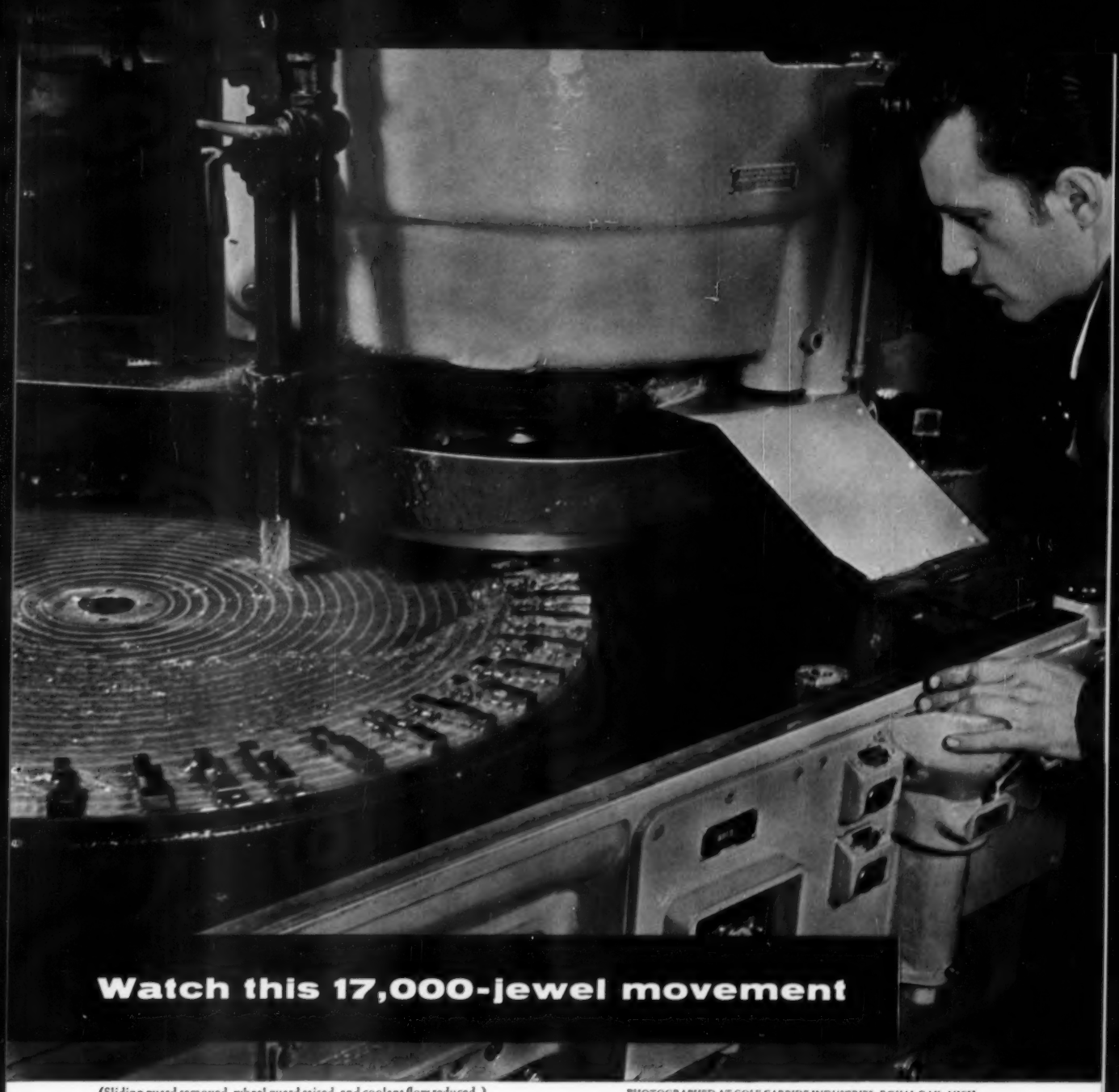
YOUR CARD DISTRIBUTOR

S.W. CARD MANUFACTURING CO.

MANSFIELD • MASSACHUSETTS

Division of: UNION TWIST DRILL COMPANY

TAPS • DIES • SCREW PLATES • GAGES



Watch this 17,000-jewel movement

(Sliding guard removed, wheel guard raised, and coolant flow reduced.)

PHOTOGRAPHED AT COLE CARBIDE INDUSTRIES, ROYAL OAK, MICH.

CARBORUNDUM's Diamond Wheels are by far your best choice for grinding cemented carbide tools. On this rotary table surface grinder, a B7 Resinoid Bond Diamond Wheel permits maximum production rates without risk of checking or cracking the carbide . . . cuts exceptionally free and cool . . . requires less pressure between wheel and work to achieve accurate size control. CARBORUNDUM also produces a top-quality line of metal bond Diamond Wheels for offhand work and cutting off. Ask your CARBORUNDUM Distributor or salesman for your free copy of Form A-1208, an authoritative 40-page booklet on "Grinding Cemented Carbides". Or write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

American Tool Works Co.
smooth operator...
A hole is a hole is a hole—but American Tool's 32-speed Hole Wizard Radial Drill makes them with the speed and consistent accuracy that precision production demands. And Federal XLS Ball Bearings keep the vertical shifting mechanism functioning smoothly.
tough customer...
The powerful impact action of this Chicago Pneumatic Wrench makes child's play out of tightening and loosening the huskiest nuts and bolts. It pounds away from day to day with no sign of fatigue. Here, too, Federal Ball Bearings can "take it".
Chicago Pneumatic

so much of industry *turns* on FEDERAL ball bearings

Dependability is a proud word, especially when you apply it to machines. And wherever you find dependable machines—in home, office or factory—you're almost sure to find Federal Ball Bearings making their vital contribution toward smooth, trouble-free performance. 12,000 sizes to solve your anti-friction problems. Hundreds of types. Produced by a 50-year-old manufacturer of ball bearings exclusively.

When Federal Ball Bearings are part of so many things you *use*, shouldn't they be part of the things you *make*?

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, N. Y.

New! Ball bearing and engineering data! *175 pages full in* FEDERAL'S CATALOG! *To get your copy, just write us.*

Federal Ball Bearings

One of America's Largest Ball Bearing Manufacturers

Acme-Gridley

fully automatic turret lathe . . . gives you increased production in inverse ratio to cost

This customer chose a model MR Acme-Gridley to produce this packing gland nut, because he was able to increase his production by more than 3 times that of the former method.

The Acme-Gridley automatically controlled cycle is predetermined to give the minimum time per piece, on *every piece*. Because each tool-slide is independently cammed and selective spindle speeds are automatically controlled, machining can be done at the surface speed best suited for required finish and tolerance.

WRITE today for your free copy of new Bulletin MR-56. See why Acme-Gridley Basic Design lets you increase production and lower unit costs.

JOB FACTS

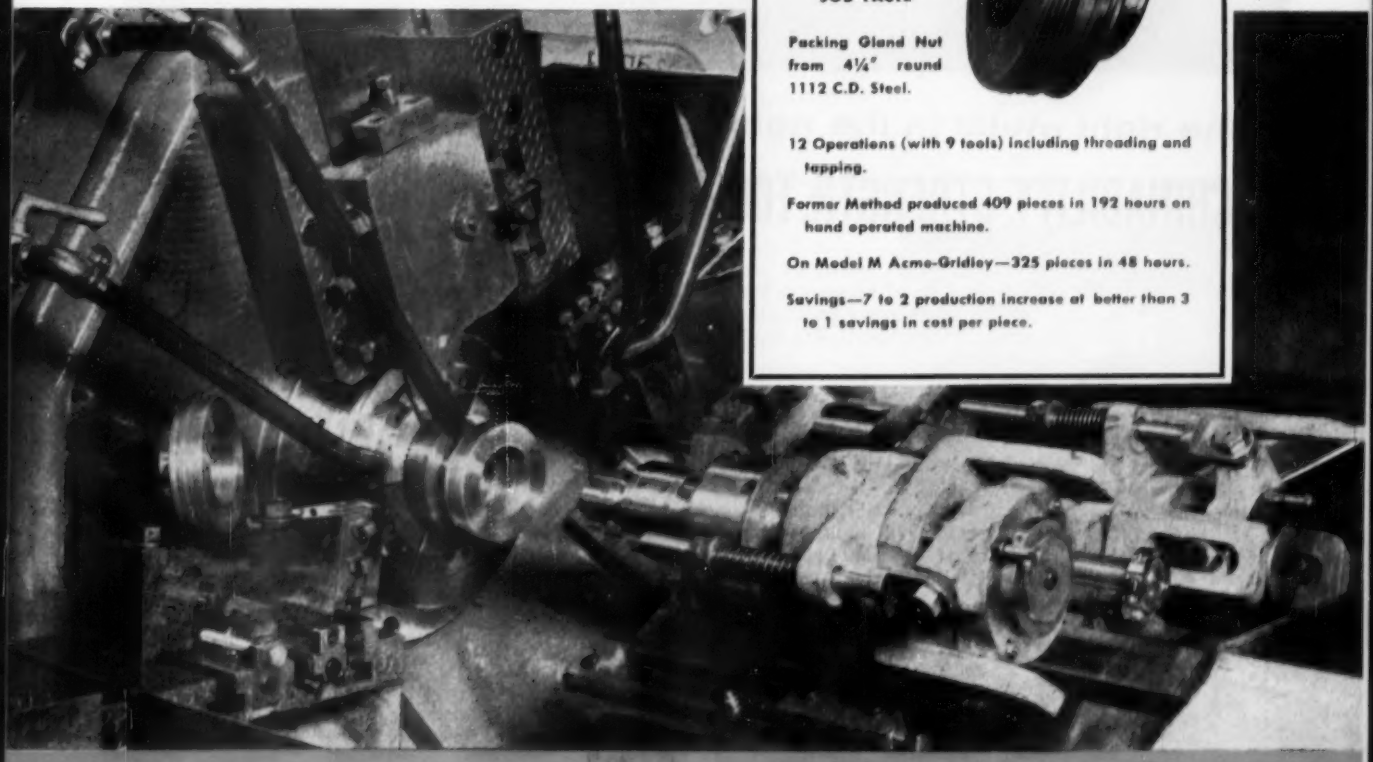
Packing Gland Nut from 4¼" round 1112 C.D. Steel.

12 Operations (with 9 tools) including threading and tapping.

Former Method produced 409 pieces in 192 hours on hand operated machine.

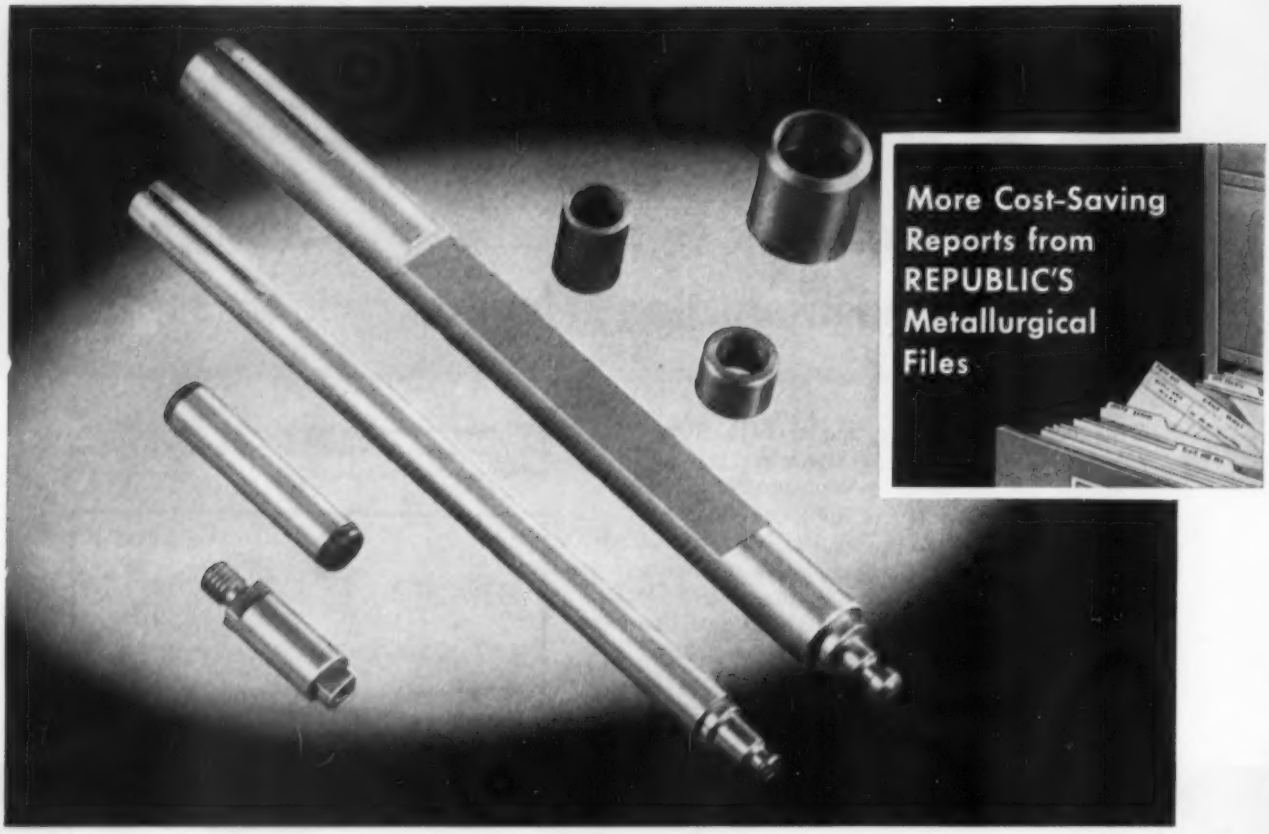
On Model M Acme-Gridley—325 pieces in 48 hours.

Savings—7 to 2 production increase at better than 3 to 1 savings in cost per piece.



National Acme

THE NATIONAL ACME COMPANY, 171 EAST 131ST STREET, CLEVELAND 8, OHIO



...the right metal in the right place provides

MACHINABILITY, STRENGTH, TOUGHNESS, CORROSION-RESISTANCE

These are four good reasons why the manufacturer of the carburetor parts shown above uses Free-Machining ENDURO Stainless Steel Bars.

His product must resist corrosion. It must resist wear and abrasion. It must have high tensile strength. And he must have machinability at a cost that permits him to be competitive.

Free-Machining ENDURO Bars fill the bill on every count. Here is a metal unsurpassed in high physical and chemical properties to which has been added the advantages provided by cold drawing—accuracy of section, close tolerance, uniform soundness and a fine surface finish.

If you make stainless steel parts or contemplate making them, Republic can meet your bar requirements. In addition to a complete range of analysis in cold finished form, Republic also supplies ENDURO® in hot rolled bars, special sections and wire.

Republic metallurgists and machining specialists will give you expert, obligation-free assistance on application, processing and use. Just send the coupon.

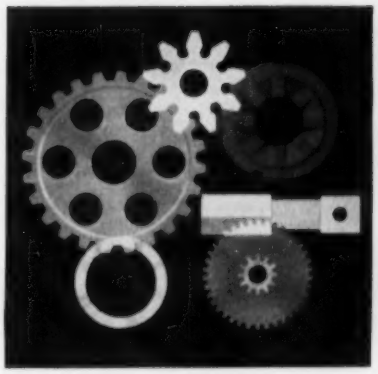
REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

Republic Iron Powder offers you new profit opportunities in small parts production.

Parts can often be made faster, more uniform and at less cost using Republic Iron Powder. It is also being used successfully in making complicated shapes which are difficult to produce economically by other means. Republic metallurgists and engineers, with a thorough knowledge of all types of metals, can help you determine iron powder's suitability to your parts production. Or, they can suggest alternate methods or materials better suited to your particular needs. This service is available without cost or obligation. Just mail the coupon.

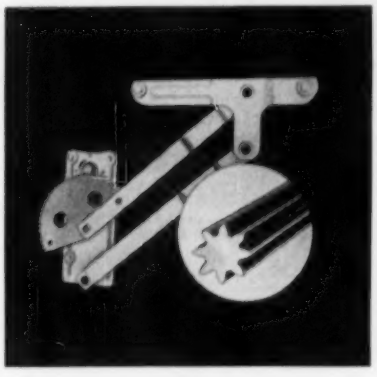


Republic Alloy Steels help manufacturer build giant earth mover to carry heavier loads at higher speeds.

The manufacturer, faced with a strength-weight problem, contacted Republic. After careful consideration of all factors, two analyses of Republic Alloy Steel were recommended and adopted for drive pinions, reduction and ring gears and the transfer case pinion shown right. These fine steels provide the manufacturer with the highest strength values—plus an unusually high strength-to-weight ratio that permits transmission of hundreds of horsepower through tough, strong gears and shafts free from excess weight. Republic will help you apply these versatile steels to your product.

Republic Cold Drawn Special Sections reduce machining on window gear to two simple operations.

The only machining operations required are cutting-off and drilling. The manufacturer uses Republic Cold Drawn Special Sections preformed to the predominating cross section of the gear. Special sections provide almost limitless flexibility in design. They permit replacement of costly assemblies with one-piece shapes. They simplify built-up, interlocking or associated parts. Higher strength, greater surface hardness and a bright, smooth finish are additional benefits of the cold drawing process. Republic Special Sections are made to specification in all grades of carbon, alloy and stainless steel.



STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-1999
3102 East 45th Street, Cleveland 27, Ohio
Please send more information on:
☐ Free-Machining ENDURO Bars. ☐ Alloy Steels
☐ Cold Drawn Special Sections ☐ Iron Powder
I am also interested in the services of a Republic
☐ Metallurgist ☐ Machining Specialist
Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

How Can Any Hack Saw Cut As Fast As a MARVEL?

GREATER EFFECTIVE FEED PRESSURE

MARVEL Series 6, 6A, 9 and 9A Hack Saws are capable of automatically applying *more than twice the feed pressure* required for most hack sawing jobs. This means that MARVEL Saws can utilize the full strength and heat resistance of the modern composite hack saw blade which is designed to cut most efficiently under heavier feed pressures. MARVEL Dual Power Feed forces the blade to cut as deeply as possible and **practical** on every stroke—to cut-off the work in the fewest possible strokes by automatically adjusting the feed pressure in relation to the changing work resistance.

MORE CUTTING STROKES PER MINUTE

MARVEL Reciprocating Crank Lever Action, providing quick return of the saw frame on the non-cutting stroke produces 33⅓% more *cutting strokes* per minute than ordinary saws *without increasing the peak blade velocity on the cutting stroke.* Result: faster cutting-off without damage to the blade.

With far greater feed pressures automatically available, plus more cutting strokes per minute, is it any wonder that MARVEL Series 6 and 9 Hack Saws will give you faster, accurate cutting-off every time?

Write for the MARVEL Catalog and the complete story on MARVEL Metal Cutting Saws

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

S-1301

MARVEL *Metal Cutting* SAWS
Better Machines—Better Blades

No other automatic on the market provides as high a degree of accuracy for work up to 2" diam. as the Brown & Sharpe No. 4 Automatic Screw Machine! And its advanced design permits top productivity on every job. For example: Super-precise spindle construction allows limits as close as 0.0003" — even at top speeds! Engineered production rates for each job *assure* maximum precision and efficiency under all conditions — hold repetitive production to close tolerances. A large, extra-convenient turret speeds set-ups and adjustments. In addition, electric control allows tools to be "jogged" easily into position; or a complete cycle to be run through by hand. And the No. 4's exclusive spider-wheel stock loader enables even a 100-lb. girl operator to easily engage a 2" bar! The unique capabilities of the No. 4 Automatic are making possible new profits in precision production — even on critical jobs like the one illustrated. It's the most *practical* automatic for all larger precision work. Write for full details. Brown & Sharpe Mfg. Co., Providence 1, R. I.

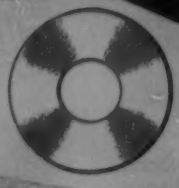
THE MOST ACCURATE AUTOMATIC for larger work!

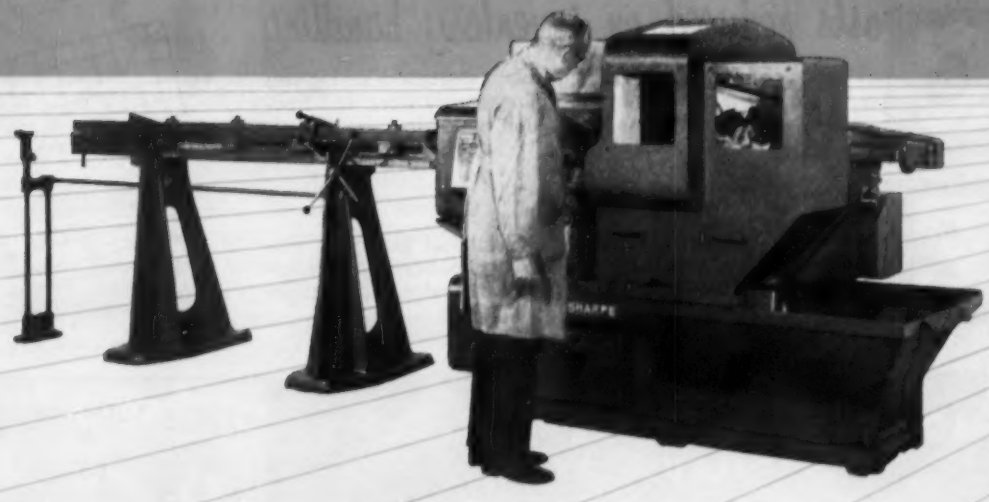
. . . the Brown & Sharpe No. 4 Automatic Screw Machine

MACHINE SPECIFICATIONS

Stock diameter	to 2"
Stock diameter (with outside feed)	to 2½"
Speed range	1965 to 17 R.P.M.
2-speed combinations	168
Speed ratios (12)	2.2:1 to 13:1

Even this Job is Easy on the No. 4!
Tolerances:
Bore I.D. 0.0003" to 0.0004"
Concentricity of bore 0.0005"
Large O.D. 0.0005"
(Overall diameter of work approx. 2")





Brown & Sharpe

HERE'S HOW YOUR SIMONDS ABRASIVE CO. DISTRIBUTOR SPELLS OUT SERVICE

S peedy supply

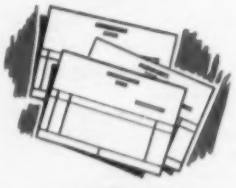
No waiting for distant shipments. Your Simonds distributor is located practically on your own "doorstep"—giving you the advantages of fast delivery, first-hand knowledge of your operation, and real help in emergencies.

E xpert guidance

A satisfied customer is more important than a single sale to your distributor. That is why he makes a point of suggesting the grinding wheel ordering quantities that give the best possible price break.

R equisitions reduced

Your local Simonds distributor is a "single source" for all your grinding needs, eliminating the necessity of requisitioning from a number of different sources.



V ariety of stock

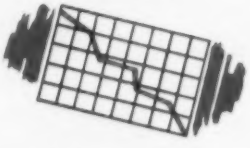
Everything you need — grinding wheels, mounted wheels, abrasive segments, polishing grain—can be supplied accurately and promptly from your Simonds distributor's complete and varied stocks.

I nstant price quotations

Your Simonds distributor is equipped to quote net prices on *any* quantity of grinding wheels instantly. No waiting for complex calculations.

C osts reduced on inventory handling

Your distributor's stockroom is your storeroom saving you much of the clerical expense of inventory work and freeing valuable space for production purposes.



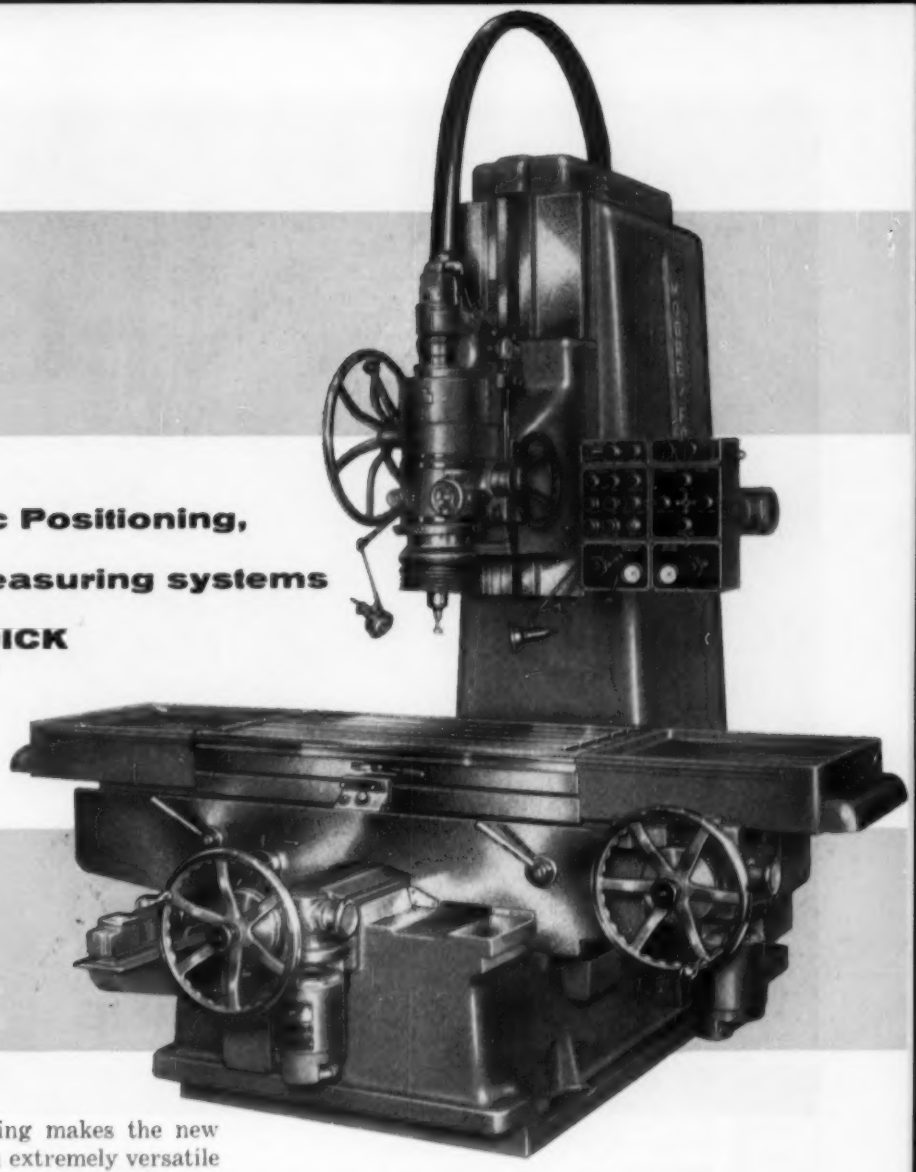
E ngineering assistance

On tough problems calling for technical aid, your distributor can bring you the benefits of Simonds field engineers. This is an extra free service — and one that might reveal new economies for you.

SIMONDS ABRASIVE COMPANY
PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco. Distributors in Principal Cities
Division of Simonds Saw and Steel Co., Fitchburg, Mass.

NOW... Automatic Positioning, choice of two measuring systems on MOORE-FOSDICK Jig Grinder!



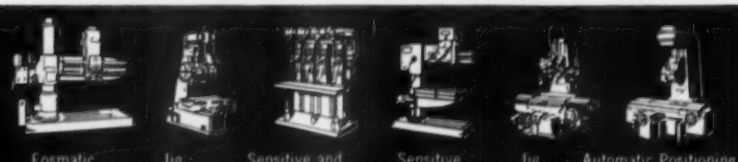
Exclusive automatic positioning makes the new Moore-Fosdick Jig Grinder an extremely versatile machine! Besides large work capacity (22" x 44" or 18" x 36" x 27" height) you get increased speed and precision. At the touch of a button, table and saddle position automatically to ± .0001"!

A choice of two precision measuring systems is available. With the new and exclusive Direct Dimension Measuring, dimensions from blueprint are simply set on direct-reading drum dials. The other system, Rod and Bar Measuring, employs measuring rods, micrometers, and for high production work, duplicating bars. Either measuring system may be installed with or without automatic positioning, but both systems cannot be installed on the same machine.

On the Moore-Fosdick Jig Grinder you can grind conical holes with taper in either direction, as well as cylindrical holes. An angular and indexing device built into the main spindle, and the recently developed slot grinding attachment, give quick, accurate grinding of any contour — *regular or irregular*. Write for price and delivery information.

Other outstanding features include: infinite range of grinding speeds—12,000 to 60,000 rpm, contour and chop grinding, spindle-housing heat control.

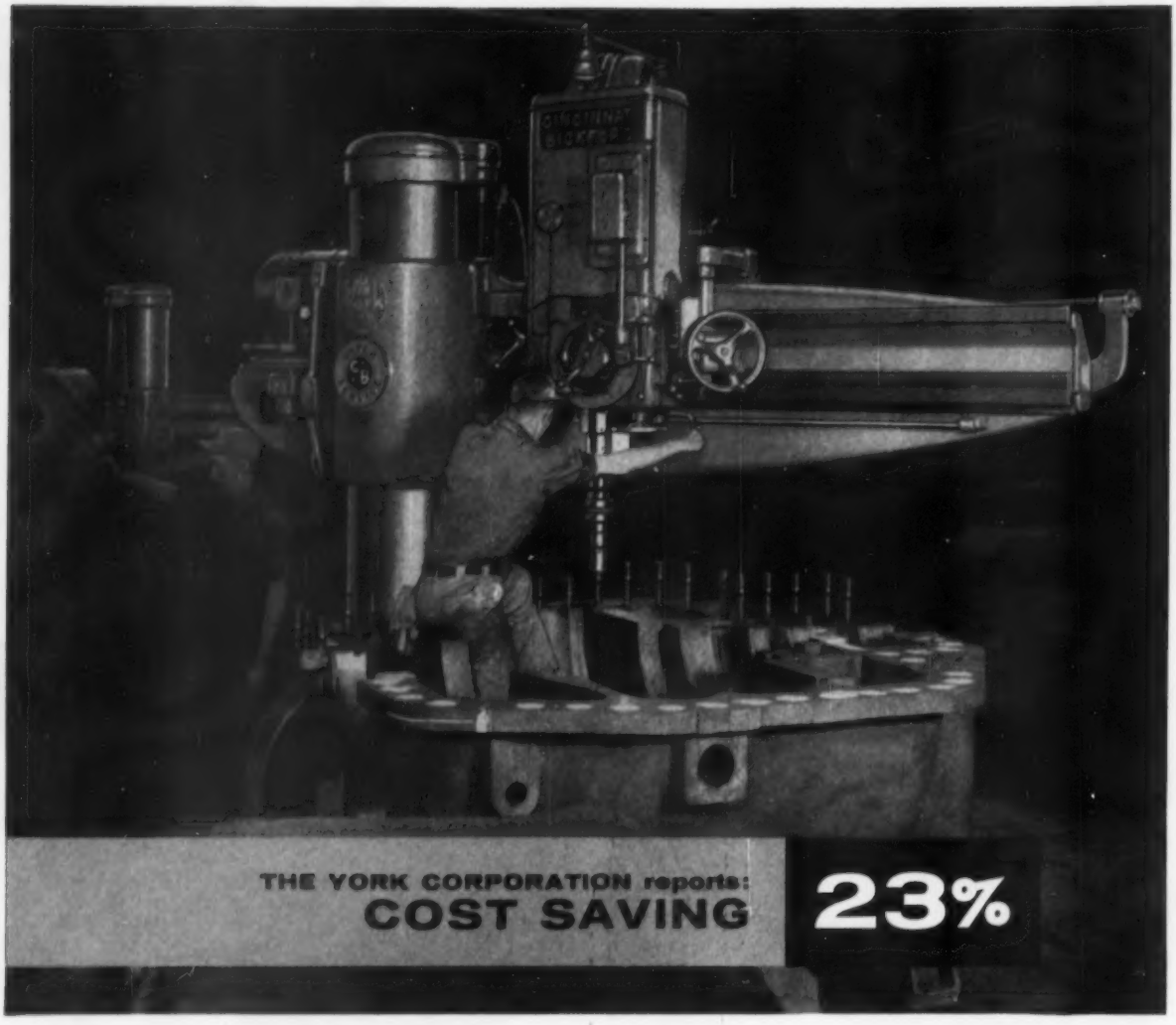
NEED JIG GRINDING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!



Fosmatic Radial Drills | Jig Borers | Sensitive and Upright Drills | Sensitive Radial Drills | Jig Grinders | Automatic Positioning Jig Borers

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK



This Cincinnati Bickford Super Service Radial Drill effects substantial cost savings in general applications. Drilling, tapping and setting fifty 1½" diameter studs on this turbo casing, shown above, is done in 185 minutes now as against 242 previously.

The York Corporation tells us that simplified, centralized controls, ease of machine positioning and minimum operator fatigue are important factors in these cost savings.

Write for bulletin covering these Cincinnati Bickford Super Service Radials.

Illustration courtesy of the York Corporation, York, Pa.

CINCINNATI BICKFORD

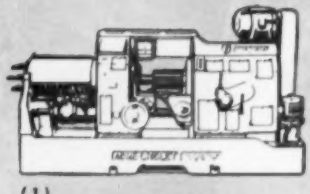
RADIAL AND UPRIGHT DRILLING MACHINES

CINCINNATI BICKFORD DIVISION
GIDDINGS & LEWIS MACHINE TOOL COMPANY
OAKLEY, CINCINNATI 9, OHIO, U.S.A.

Acme-Gridley . . .

The World's ONLY COMPLETE LINE

of Single and Multiple Spindle Bar and Chucking Automatics



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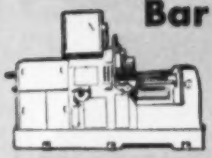

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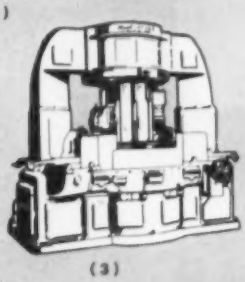

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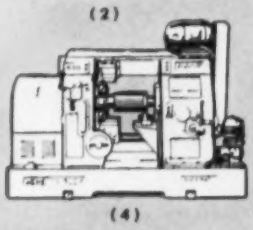


(4)

MACHINERY DIVISION—(1) Bar Automatics in 4, 6 and 8 spindle Models, 21 sizes ⅛ to 7⅜" capacities; (2) Single Spindle Automatics, Bar type 4 sizes 3½ to 6", Chuck type 12" capacity; (3) Vertical Chuckers 8 spindle 14" capacity; (4) Chucking Automatics 4, 6 and 8 spindle 8 sizes 5¼ to 12"

Since building the first successful multiple spindle automatic lathe in 1893, the energy and resources of the National Acme Co. have been directed toward the constant improvement and engineering to maturity of these "Master Tools of Industry". How well we have succeeded is gauged not alone by the fact that more automatics bear the NAMCO nameplate *but also by the fact that every automatic bar and chucking machine built today employs the basic principles first perfected in the National Acme prototype.*

Other National Acme "Firsts" include pioneering circular cutter threading tools to enable mass production thread cutting, introducing self-opening thread rolling heads, and building heavy-duty switches, solenoids and other electrical components—*"Built As A Machine Tool Builder Would Build Them".*

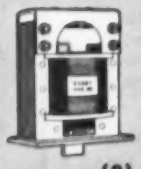
(5)

THREADING TOOLS — Self-Opening Dies (5) in capacities ⅜ to 6½"; Collapsible Taps 1⅜ to 5" capacities; Self-Opening Thread Rolling Heads (6) ⅛ to 2" capacities.

(6)

(7)

(8)



(9)

ELECTRICAL—Switches for heavy duty Control Station (7), Limit (8) and Motor Starter; Solenoids (9) push or pull to 25 lbs.

National Acme Nameplates Mean SERVICE . . . Anywhere . . . Anytime

National Acme

THE NATIONAL ACME COMPANY, 171 EAST 131st STREET, CLEVELAND 8, OHIO

SALES OFFICES: • NEWARK 2, N. J. • CHICAGO 6, ILL. • DETROIT 27, MICH.

Greatest thing that's happened since the Madison Boring Tool!

Madison-Faessler Roller-Burnishing Tool

- ***Superior Surface Finish*** — five micro-inches or better.
- ***Single Pass Operation*** — for roller-finishing bores of any length.
- ***Fast, Easy to Set Up*** — on conventional shop machines.
- ***Adjustable in Size*** — for easy-to-handle job changes.
- ***Off-the-Shelf Delivery*** — of standard tools in most popular sizes.
- ***Extra Long Life*** — thousands of passes before parts replacement.

No wonder a customer said it's "the greatest thing since the Madison Boring Tool!" If you'd like to know more about this fabulous tool, or our roller-burnishing tools for O.D. cylindrical surfaces as well as tapers and radii, just send coupon today.

Let the man with the holes in his head tell you how to cut costs in:

- ★ **Boring**
- ★ **Reaming**
- ★ **Deep Hole Drilling**
- ★ **Trepanning**
- ★ **Roller-Burnishing**
- ★ **Gaging**

MAIL COUPON TODAY

☐ Please send me bulletin on the Madison-Faessler Roller-Burnishing Tool.

☐ Have representative call.

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

Inner Diameters Are Our Business

MADISON-FAESSLER

TOOL COMPANY *MOBERLY, MISSOURI*

ASSOCIATED WITH MADISON INDUSTRIES, INC.

New 6" x 18" hand feed

Thompson Grinder

FOR SHOPWORK OR TOOL ROOM

Completely anti-friction and permanently lubricated machine. Available with all types of attachments found on tool room surface grinders including interchangeable horizontal and vertical wheel heads. A Thompson high quality precision machine at this low price.

LOW PRICE* HIGH QUALITY

PRECISION PETE says:

FOR LOW COST AND QUALITY YOU JUST CAN'T BEAT THOMPSON
Make your next hand feed grinder a Type D Thompson . . . write today for the new descriptive catalog, D-55

* Write today for quotation

Call, write or wire today

Thompson Grinders

The Thompson Grinder Company at Springfield, Ohio

Q. Why does Blanchard grind its own machine parts on a Blanchard?

A. It's the only way we know to get highest quality at lowest cost!

Shown here are 117 different parts of a #18 Blanchard Grinder. 239 surfaces on these 117 parts were ground on a Blanchard, for the simple reason that *there isn't any better way.*

Everyone who uses Blanchard Grinders knows that Blanchard elements are machined with extreme accuracy . . . that they *have to be!*

Furthermore, Blanchard users everywhere would undoubtedly agree fully with these two actual statements recently made by customers:

"There is no greater machine tool money value than a Blanchard. It is the best buy we ever made".

"Until our Blanchard went to work, I never realized I could actually save so much, as compared to previous methods of machining flat surfaces".

If you do not own a Blanchard, we invite you to select some of your own components, and let us give you estimates to compare with your present quality control tolerances and machining costs. Chances are you'll find it will pay you to **"PUT IT ON THE BLANCHARD".**

P. S. You guarantee yourself full benefit from your Blanchard Grinders when you use the correct Blanchard abrasive wheels!

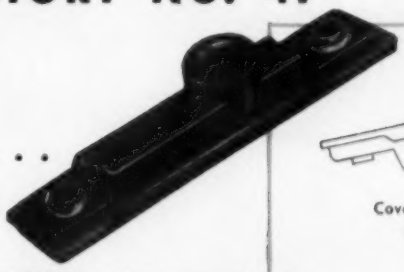
Send for free copies of "Work Done on the Blanchard"

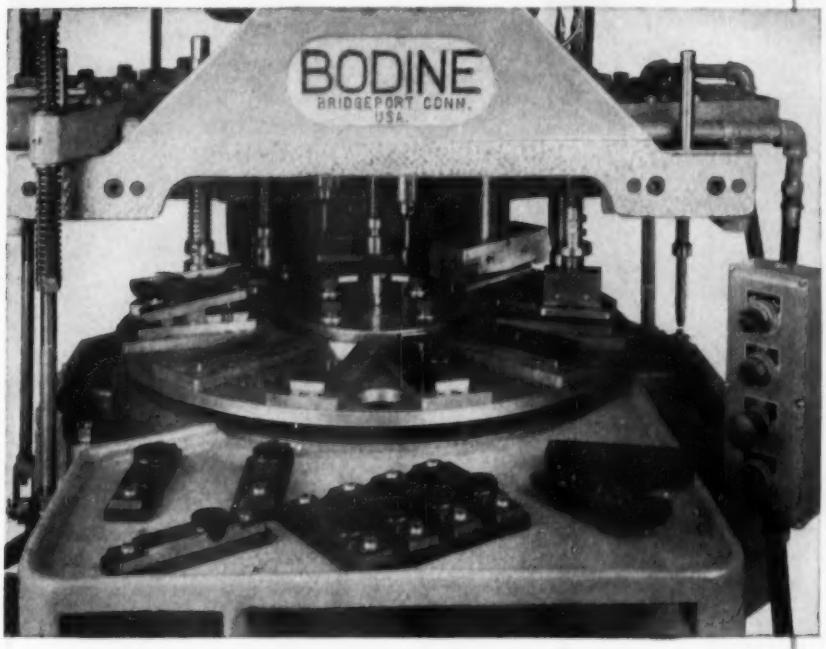
PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY **64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.**

Bodine CASE HISTORY NO. 41

MULTIPLE OPERATIONS . . .
MULTIPLE TOOLING . . .
METAL AND PLASTIC . . .
ON ONE VERSATILE MACHINE

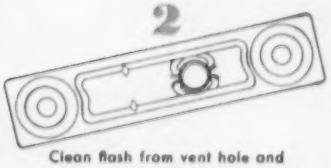




1

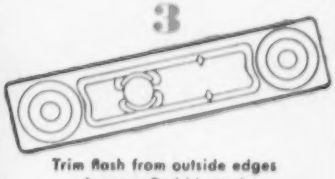
Covers hand-loaded, one piece per stroke.

2



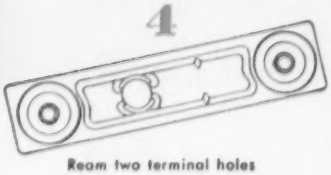
Clean flash from vent hole and slots. Carbide tools.

3



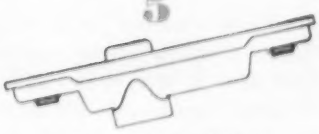
Trim flash from outside edges of cover. Carbide tools.

4



Ream two terminal holes in lead inserts.

5



Hollow-mill two terminals in lead inserts . . . using inverted spindles.

6

AUTO EJECT.

The unusual features of this Bodine tooling lie in the many different types of operations performed in one high-speed cycle, and also in the multiple tooling of the machine to handle many different sizes of these auto battery cell covers, both 6-volt and 12-volt.

Major battery producers now use 15 of these production units. Bodine basic design, as will be seen in the photograph, provides ample room for inclusion of the dies required for trimming operations, as well as the rotary spindles.

PRODUCTION: 1,250 covers per 50-minute hour . . . with machine operating at 25 strokes per minute.

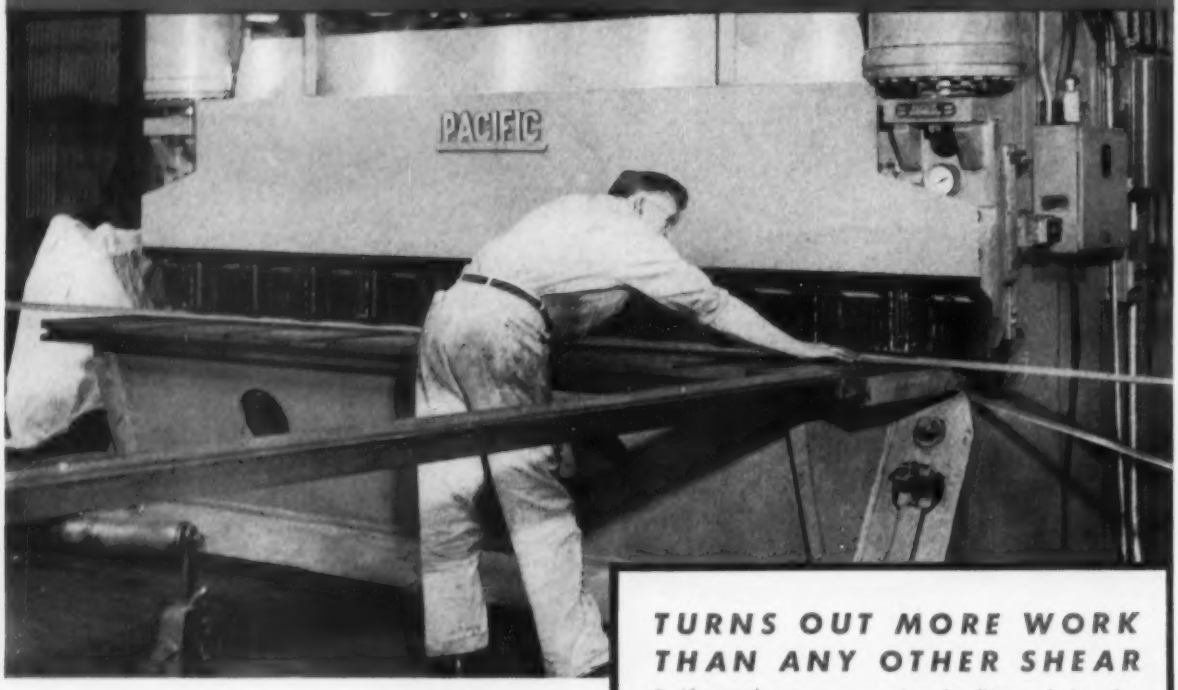
If you are looking for increased output at lower cost, without sacrifice of quality . . . on assembly or production operations, or a combination of both . . . talk to Bodine first. Our experience can save you money and costly engineering.

Write Dept. AM-10

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

78D55

PACIFIC HYDRAULIC SHEAR cuts sheets or heavy plate noiselessly, accurately, at lowest cost



. . . knife blade lasts longer, shear cannot be damaged by overload

Lower cost shearing can be yours with this remarkably efficient shear that eliminates shock, the main cause of blade damage and wear. Pacific Hydraulic Shear gives you speed, accuracy, safety, economy and long, trouble-free performance. It cuts soft aluminum or polished stainless without marking . . . it cuts narrow strips or trims fine edges from plates or sheets. At a single setting of the blade clearance it cuts any piece between 20 gauge sheet and full capacity. Gap type shear cuts pieces far longer than the shear length. Simple hydraulic system eliminates troublesome maintenance of mechanical shears. For production or piece work, Pacific Hydraulic Shear can be the biggest profit-making tool in your plant.

Write for literature

TURNS OUT MORE WORK THAN ANY OTHER SHEAR

Pacific speeds set up, measuring, handling and the other necessary operations that take up 95% of cutting time. It is a one-piece, welded steel structure that provides the rigidity necessary to shear heavy plates accurately. Straight-line downward pressure from 2 hydraulic cylinders keeps the shear from twisting or deforming under heavy loads. Slide ways are exceptionally long and heavy so that blade clearance is precisely maintained under heavy loads. Unique hydraulic back gauges controlled from the front rapidly move into place and can be inched slowly into the exact setting within thousandths of an inch. Blade clearance is adjusted in less than 5 minutes by calibrated screw in front of machine. Hydraulic hold-down provides positive gripping of work piece. Pressure is adjusted in seconds to match any work.

Pacific Shear is operated by movable foot pedal placed wherever most convenient. Dual control pedal available. Shear cannot be damaged by overload. Operator cannot possibly get his fingers or hands under the knife. Movement of shear either in inching or cutting is instantaneously responsive to the foot control pedal so that the blade can never get out of control.

PACIFIC INDUSTRIAL MANUFACTURING COMPANY
848 - 49TH AVENUE • OAKLAND 1, CALIFORNIA
PLANTS: OAKLAND, CALIFORNIA AND MT. CARMEL, ILLINOIS

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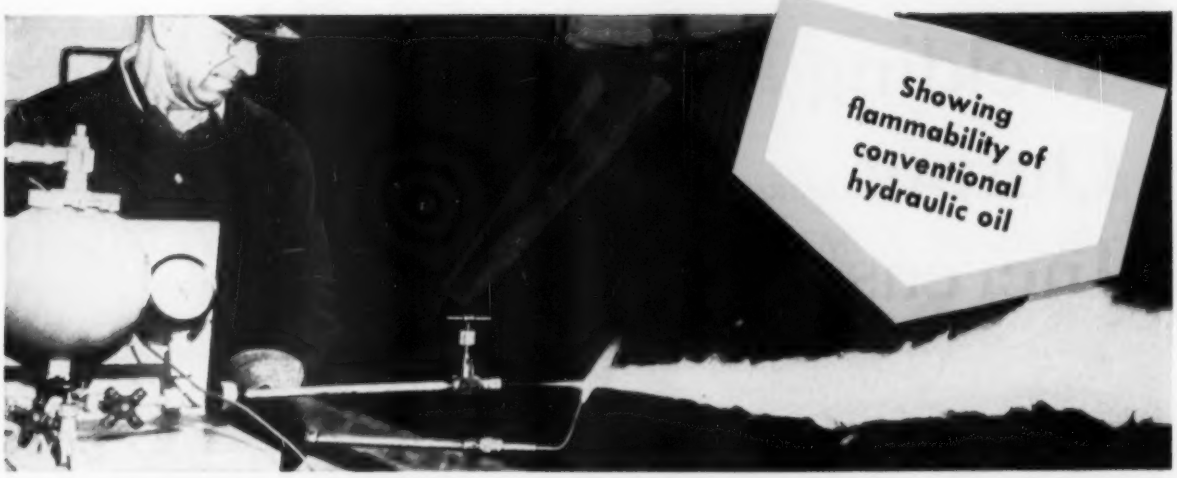
LOS ANGELES—Tornquist Machinery Co. • PORTLAND—Portland Machinery Co. • SEATTLE—Buckner Weatherby Co. • SALT LAKE CITY—Todd Machinery Co. • DENVER—Richard Ives & Co. • HOUSTON—Butcher, Carter & Preston Co. • DALLAS—Machine Tool Associates • TULSA—Martin Machinery Co. • KANSAS CITY, DES MOINES & ST. LOUIS—Moehlenpah Engr. Co. • NEW ORLEANS—Dixie Mill Supply Co. • ATLANTA—Allison Machinery Co. • NORFOLK—Tidewater Supply Co. • PHILADELPHIA, BALTIMORE—Calco Machinery Co. • NEWARK— G. M. Pearse & Co. • PITTSBURGH—Steel City Tool & Machinery Co. • BOSTON—Wigglesworth Machinery Co. • ROCHESTER—Macaulay Machinery Co. • CLEVELAND—Wigglesworth Machinery Distributors • INDIANA—Behrend Machinery Co. • CHICAGO, MILWAUKEE—The Gute Co. • DETROIT—Taylor-Thompson Machinery Co. • MINNEAPOLIS—Satterlee Corp. • LOUISVILLE—Louisville Machinery Co. • ALBUQUERQUE—Industrial Supply Co. • CANADA—Williams & Wilson Ltd.



Flame tests prove its fire-snuffing ability

SHELL IRUS FLUID 902

Entirely new formula: Shell Irus Fluid 902 is a special formulation . . . product of three years' development and field testing. It is suitable for nearly all industrial hydraulic systems, as a direct replacement for presently used oils. *Here is a fire-resistant hydraulic fluid that can be widely used.*

Non-corrosive: Shell Irus Fluid 902 contains no corrosive ingredients. It has no harmful effects on seals, fittings or bearings. It does not promote rust.

No major modification necessary . . . simply clean present fluid thoroughly out of system and replace directly with Shell Irus Fluid 902. You can use it with complete confidence. Write for test data and all information.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

Welding Output Increased

on Western Electric Coin Box Production

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals • Welding Materials

Suppose you needed to spot-weld sheet steel to steel forgings, in hard-to-reach locations. Western Electric's plant at Indianapolis had this problem on telephone coin boxes. Custom-designed electrodes and holders had seemed the way to do the job.

But, since using a standard Mallory heavy-duty offset holder and Mallory bent tips, their welding costs have been reduced and production rate has been increased.

Output increased. The number of parts welded per shift has been increased significantly. Reason: less tip dressing, less setup time loss, cooler operation and minimum respotting.

Longer electrode life. Replacement rate is now less. Reason: better cooling of electrodes . . . all the way to the tip.

Less down time. Re-dressing is now needed only once per shift.

Chances are that you, too, can make substantial savings in resistance welding production, by using Mallory electrodes, holders, seam welding wheels, dies, castings and forgings . . . and by taking advantage of Mallory engineering service in applying these products effectively to your problem. See your local Mallory welding distributor for prompt service, and write to us for our resistance welding catalog.

Expect more . . . Get more from

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

pneumatic feed — for speed ... on the SEMI-AUTOMATIC

Nichols Miller

In selecting the Nichols Miller with pneumatic table feed, you obtain precision and a high-production semi-automatic machine. The push-button controlled power feed is entirely automatic — leaves the operator free to merely load and unload the work. Often he may run two or three millers with ease. The air cylinder works against the cutter *and* the hydraulic cylinder — completely eliminating chatter and table jump. The unit provides rapid advance from loading position to the cutter, infinitely variable cutting feed, and rapid return to loading position. Also available with power vertical feed to spindle head. If you want high production to "tenths", investigate the Nichols Semi-automatic!

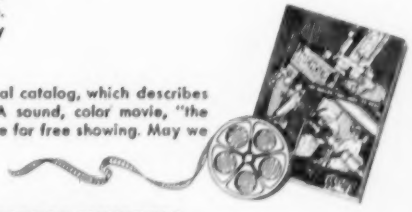
"the miller that uses its head!"

CONDENSED SPECIFICATIONS

Table Working Surface	6¼" x 21"
Longitudinal Travel	
Pneumatic	9"
Cutting Stroke	5⅛"
Hand Screw (Optional)	10"
Transverse Travel	7"
Vertical Travel — Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000 R.P.M.	
Weight	1250 lbs.

The Semi-automatic set up with air vise on a production job. Vise operated automatically by table movement.

Write today for the Nichols general catalog, which describes the six models of Nichols Millers. A sound, color movie, "the Miller that Uses its Head" is available for free showing. May we reserve it for you?



MANUFACTURED BY W. H. NICHOLS COMPANY WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

76-F MAMARONECK AVE.
WHITE PLAINS, N. Y.

To get clean wipers at the tool crib, this lathe operator must make the hike, then stand in line. Dirty wipers in hand, he makes the trip at least once a day, takes several minutes to do it.

He has to waste 60 minutes a week

Easy to distribute

Really soak up oil . . .

Always a clean one handy . . .

Just toss 'em in the trash . . .

With a carton of 125 clean Scott Wipers at every workbench, daily wiper replacement is often unnecessary. One carton can last for days and a man has a fresh supply right at his fingertips.

. . . He stays on the job

The difference is . . . Scott Wipers

Check your production line. See how much time the men are forced to waste in order to keep supplied with fresh wiping material.

It adds up to more lost production time than you might think.

Scott Wipers are disposable. A man picks up a carton when he checks in . . . keeps it with him all day long. He uses one Wiper thoroughly—throws it away. Complicated distribution is ended. So is sorting, baling, and laundering.

And with fresh Scott Wipers there's no danger of hidden chips damaging men or metal.

Your local Scott representative or distributor will demonstrate the Scott Wiper in your plant. Call him or mail this coupon today.

Another quality product of . . .

SCOTT PAPER COMPANY

Scott Paper Company
Dept. W-6, Chester, Pa.

Please send me more information about Scott Wipers.

Name _____

Company _____

Position _____

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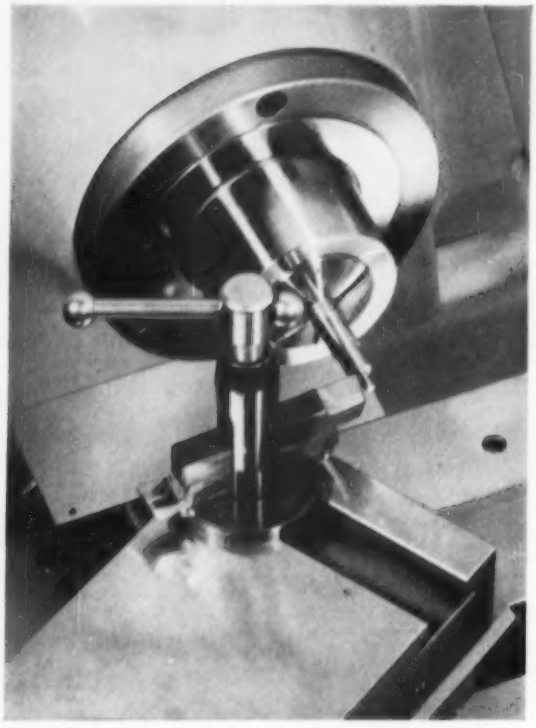


When

ACCURACY

REALLY COUNTS

SPECIFY:

HARDINGE

PRECISION DRAW-IN COLLETS

FOR YOUR
LATHES-MILLERS-GRINDERS

CARRIED IN STOCK FOR PROMPT DELIVERY IN:

Baltimore, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, Minneapolis, New York, Oakland, Philadelphia, St. Louis, Toronto, and Montreal

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

Why CIMCOOL leads the parade . . .

There are three booming reasons why CIMCOOL® is way out in front—actually the largest selling chemical cutting fluid in the world. And each deserves a rousing cheer as they pass in review:

CIMCOOL LOWERS COSTS because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.

CIMCOOL DOES A BETTER JOB because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.

CIMCOOL IS CLEAN, doesn't soil hands or clothing. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So join the parade—switch to CIMCOOL, then listen to the sweet music of your machines as they hum with increased production . . . and to the jingle of money saved.

For complete details on all the advantages of CIMCOOL Concentrate, consult your CIMCOOL distributor. He'll be happy to tell you all about CIMCOOL—as well as the entire family of CIMCOOL Cutting Fluids. Or contact us direct and we'll send one of our Cincinnati Milling-trained machinists to call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

*Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive**—For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

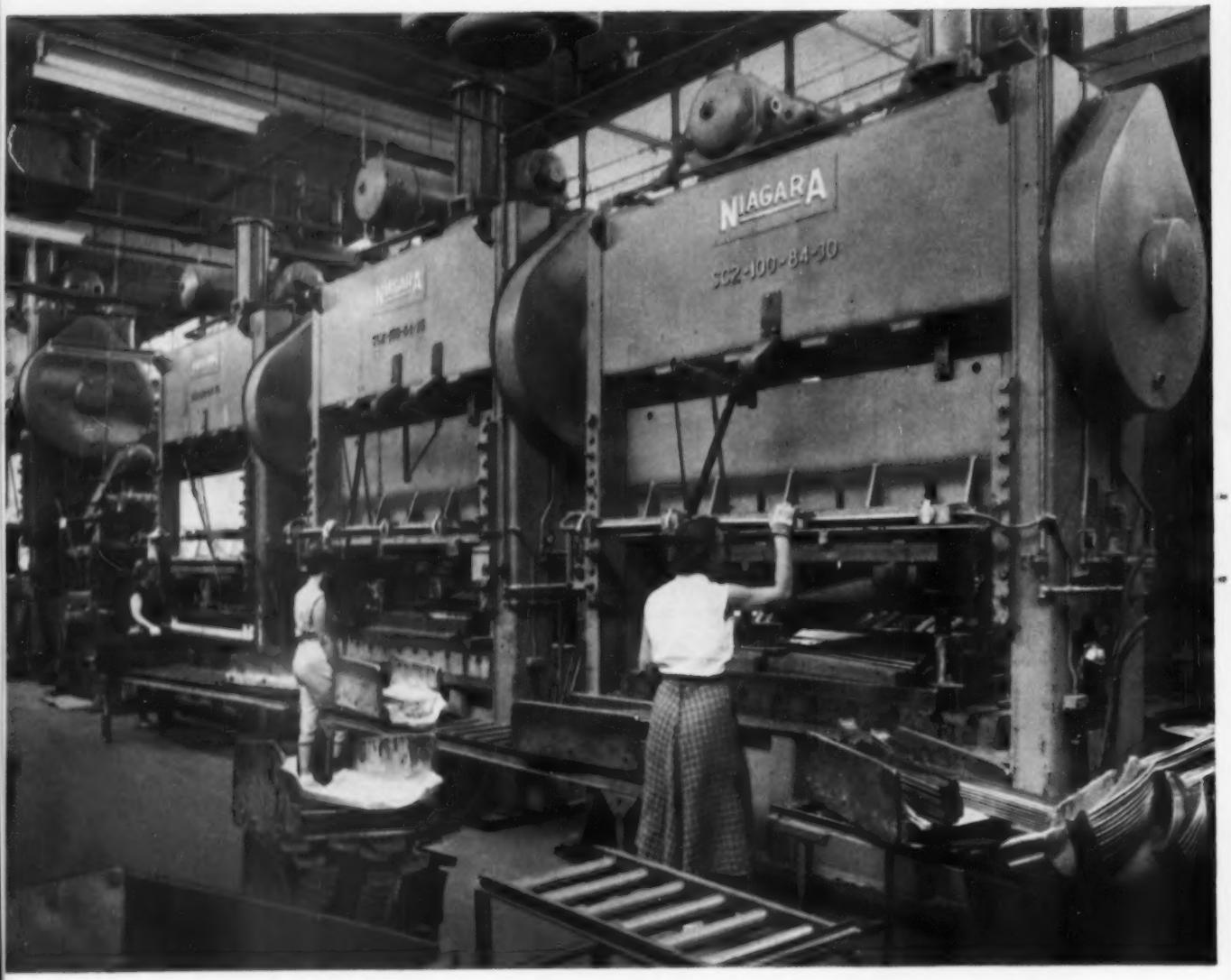
CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

"we concentrate on Niagara



NIAGARA **DOUBLE CRANK STRAIGHT**

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

presses...

...they require a minimum of maintenance"

In-line operation of four Niagara Series SC-2 Presses, engaged in progressive production of automotive side moldings from .025" #430 stainless steel.

Press operator shows a blank and formed molding which will grace one of the "Big Three" cars.

Producing up to 1,750,000 automotive moldings per month, these four Niagara Double Crank Straight Side Presses do the work of eight for a large Midwestern metal stamping firm. Their long beds enable the outfitting of each press with two sets of dies for two separate operations.

"We believe in standardizing. That is why we concentrate on Niagara Presses. They require a minimum of maintenance. When jobs come in, we are sure we can get them out. They are a volume machine," says the vice president and plant superintendent.

. . . and with good reasons, this famed line of Niagara presses requires a minimum of maintenance:

- *Rugged, integral, all-welded steel frames of exclusive triple box section design properly resist deflection to assure greater accuracy and longer die life.*
- *Laminated non-metallic ways of box type welded steel slides are a positive safeguard against scoring and assure trouble-free service.*
- *Low inertia pneumatic friction clutch reduces heat and wear. Only the shaft and driving plate are started and stopped at each cycle. Most of the clutch weight continues to rotate with the flywheel.*
- *Outboard mounting of clutch makes it accessible for easy maintenance . . . without disturbing any drive or crown parts.*
- *No adjustment for wear of clutch plate is necessary. It is self-compensating.*
- *Clutch linings are cycle-welded to plate, without rivets, increasing effective life.*
- *Brake shoes are full floating and self-aligning . . . cannot cock, bind or wear unevenly.*
- *Steel gears run in totally enclosed oil baths. Centralized pressure lubrication sends vital oil to journals, ways and wherever necessary for long efficient, service life.*

Like this well known metal fabricator, it will be profitable for you, also, to consider standardizing on Niagara presses. First of all, Niagara has the most to offer . . . straight side double crank, single crank and eccentric geared, open back inclinables and dozens of others. Secondly, in the words of the same company's purchasing agent: "The prices on Niagara Presses are right . . . and they do the job."

Built in 50 through 400-ton capacities, Niagara Double Crank Straight Side Presses are readily equipped with automatic feeds, variable speed drives, iron hands and other automatic materials handling devices so popular with the automotive and appliance industries. Post yourself on this important line by requesting Bulletin 64.

SIDE PRESSES

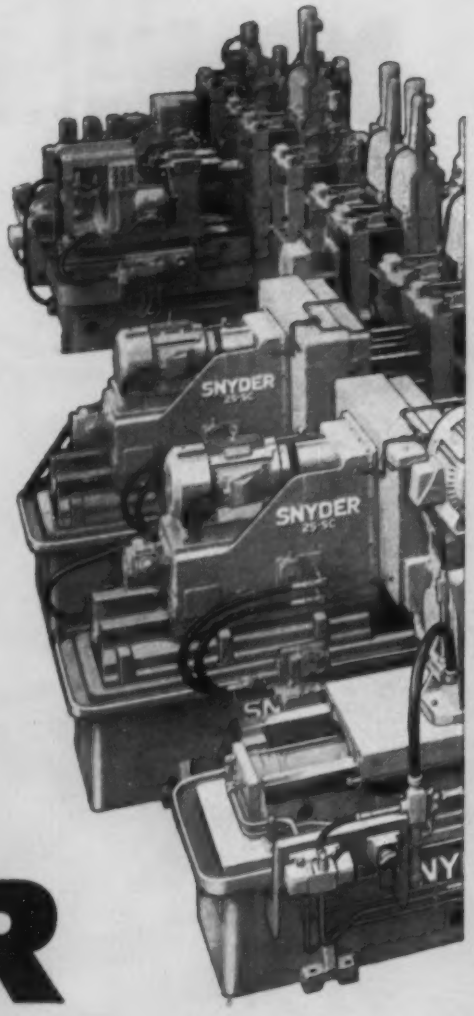
NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES:

Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U. S. cities and major foreign countries

UNIQUE FEATURES IN SNYDER 9-SEGMENT, 24-STATION, IN-LINE AUTOMATED TRANSFER MACHINE



MACHINE for processing converter housings; independent control panels permit individual segment operation (co-ordinated with master panel); electric circuits can be individually checked by Circuit-Sleuth Panel; at Station 4, workpiece is re-oriented 90°; at Station 21, two dowel holes and one transmission hole are precision bored to .001 in size; at Station 22 these holes are automatically precision air gaged.

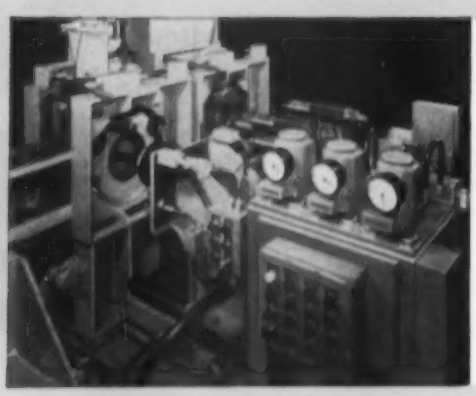
Workpiece reaches machine finish ground on both faces; machine performs 59 operations, delivers workpiece completed and automatically inspected. Production, 128 pieces an hour at 100% efficiency.

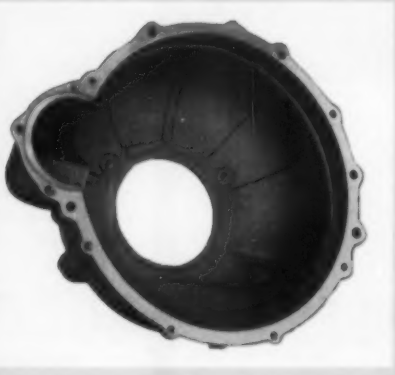
SNYDER

TOOL & ENGINEERING COMPANY

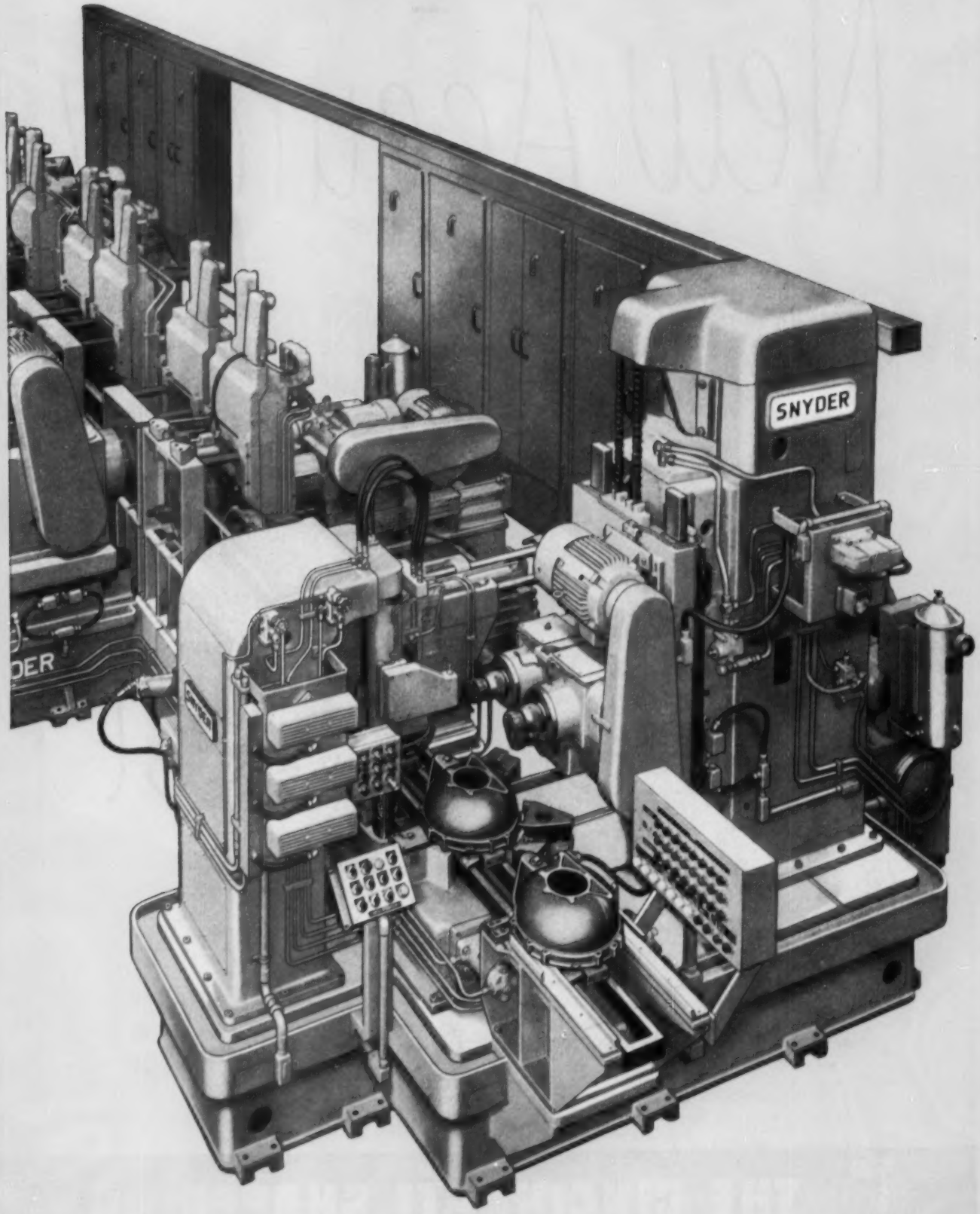
3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

31 Years of Special Machine Tools with Automation





Boring and air gaging stations.


SNYDER

New Accuracy

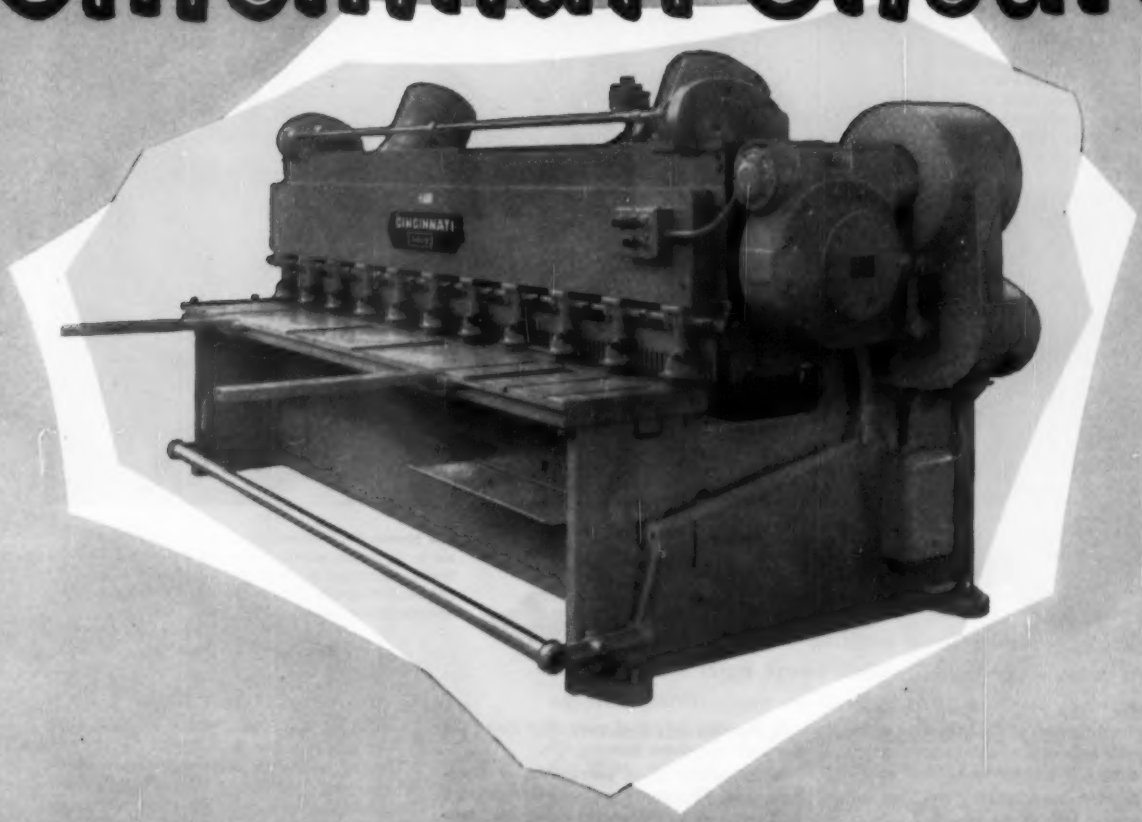
New

New Quiet

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Cincinnati Shears



New design in Cincinnati Shears has brought a new quiet and accuracy in performance.

New low rake has increased accuracy—producing blanks to very close tolerances with straight clean edges.

The new design, powerful hydraulic holddowns operate quietly and assure full pressure for holding. Front control of the power back gauge saves time in operation and gives a positive, accurate, easy control of gauging from operator's working position.

Write for catalog S-7R.

How Eastman Kodak gets Extreme accuracy...fine finish... years of trouble-free grinding

Norton wheel spindle a key factor in grinding performance that means...

steady savings!

Installed In March 1936 at Eastman's Kodak Park Works in Rochester, N. Y., this Norton 10" x 96" Type C Cylindrical Grinder grinds alloy steel rolls to precision accuracy and very fine finish. Original wheel head spindle bearings have required no servicing in more than 18 years of 8 to 24 hours daily operation.

The Norton Wheel Spindle Unit is an outstanding aid to the speed, accuracy and long service life of Norton cylindrical grinders. Note its over-all ruggedness and big heavy bronze bearings covering over half the spindle body.

Why are Norton cylindrical grinders so fast and accurate over such a wide range of precision finishing and heavy stock removal jobs?

Why do these hard-working machines last so long, cost so little to maintain?

Advanced features like the Norton wheel spindle unit are the answer. Advantages of this typical Norton development for better, lower cost grinding include:

- ***Over 50% of spindle body enclosed in two large heavy-duty, hard bronze bearings for extra long life.***
- ***Rugged proportions, and metals toughened by special heat treating, are further aids to long service.***
- ***Rigid support over practically the entire spindle surface affords maximum resistance to wheel pressures.***
- ***Bearing length of more than twice the diameter increases bearing life.***
- ***Automatic flood lubrication of bearings, with flow continually visible through bull's-eyes — an important safety and control feature.***
- ***End thrust taken on two large, hardened steel surfaces, also flood lubricated.***
- ***Modern precision boring for exact oil clearance keeps lubrication at top efficiency.***
- ***Wheel speed changes possible without readjusting bearings.***
- ***Extremely low unit pressure, due to long, continuous bearing surfaces, permits fast cutting and enduring accuracy.***

For further facts on how Norton cylindrical grinders can benefit your production, see your Norton Representative. Or write direct for Catalogs. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

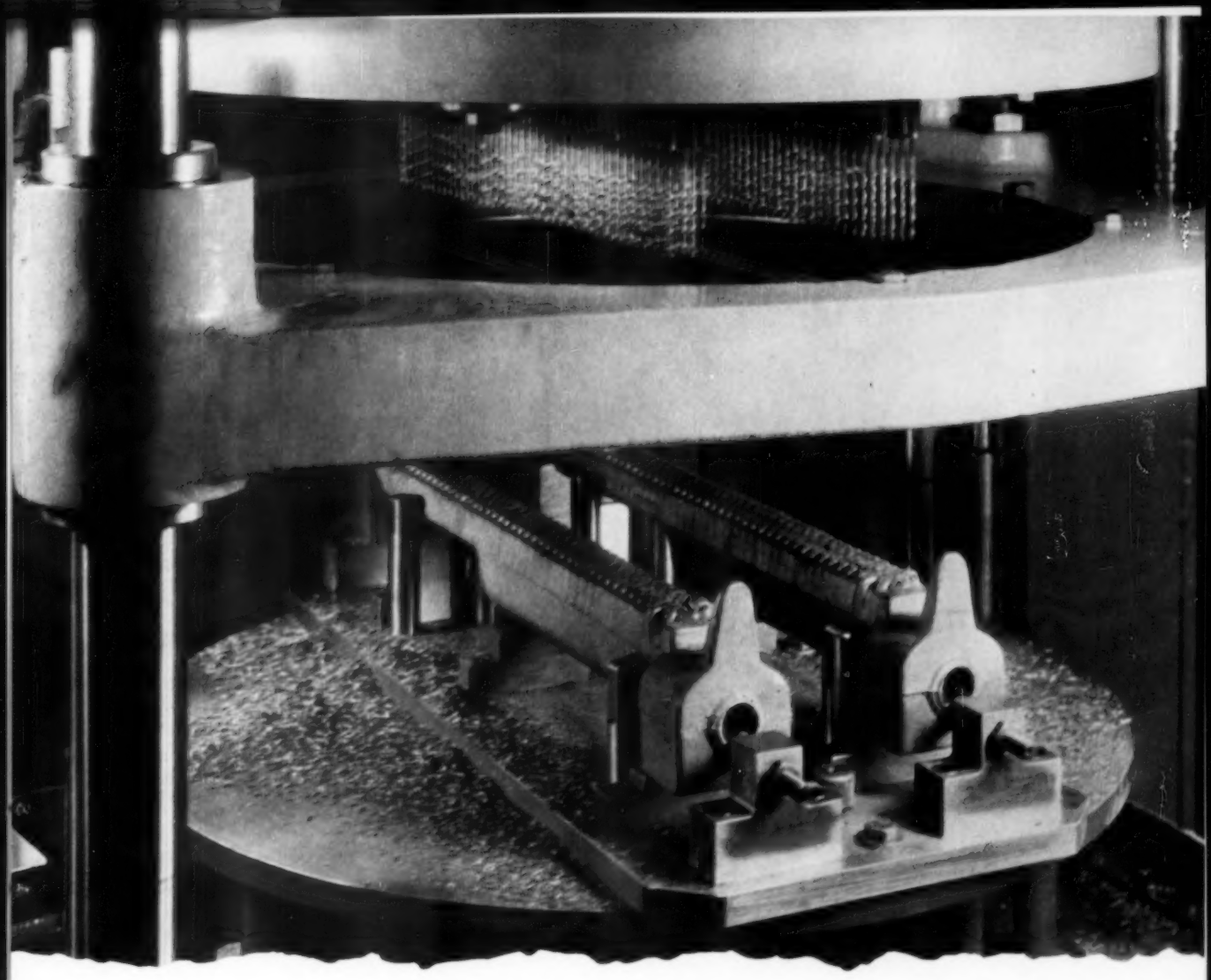
To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

District Sales Offices: Worcester • Hartford • New York (Teterboro, N. J.) • Cleveland • Chicago • Detroit



Uniform quality and high performance of CLE-FORGE High Speed Drills can help you reach production quotas

COSTLY "DOWN TIME" REDUCED!

• You can keep your drilling operations *on schedule* with CLE-FORGE High Speed Drills. These fine quality tools give superior performance on *every set-up* . . . and you can rely on their *uniformity* day after day, month after month, year after year.

◈ Why not ask a Cleveland Service Representative for suggestions on reducing "down time" and increasing production in *your* shop? Contact our nearest stockroom, or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

A leading machine company, supplying gears for mining and a variety of other heavy machinery, uses Osborn's Brushamatic 4 and a brushing cycle of 6 seconds a side to finish these gears in lots of 20 and up.

Pays Off...

25 for 1

REMOVING burrs from the teeth and internal spline of this gear was once a 5 minute, hand filing operation. Using Osborn Brushamatic® methods, only 12 seconds are required to remove these burrs. In addition, power brushing blends all surface junctures, reducing fracture-causing concentrations of stress.

An **O**sborn **B**rushing **A**nalysis, made in your plant and at no obligation, will show how *you* can improve quality while making similar savings in finishing time and cost. Write *The Osborn Manufacturing Company, Dept. C-51, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

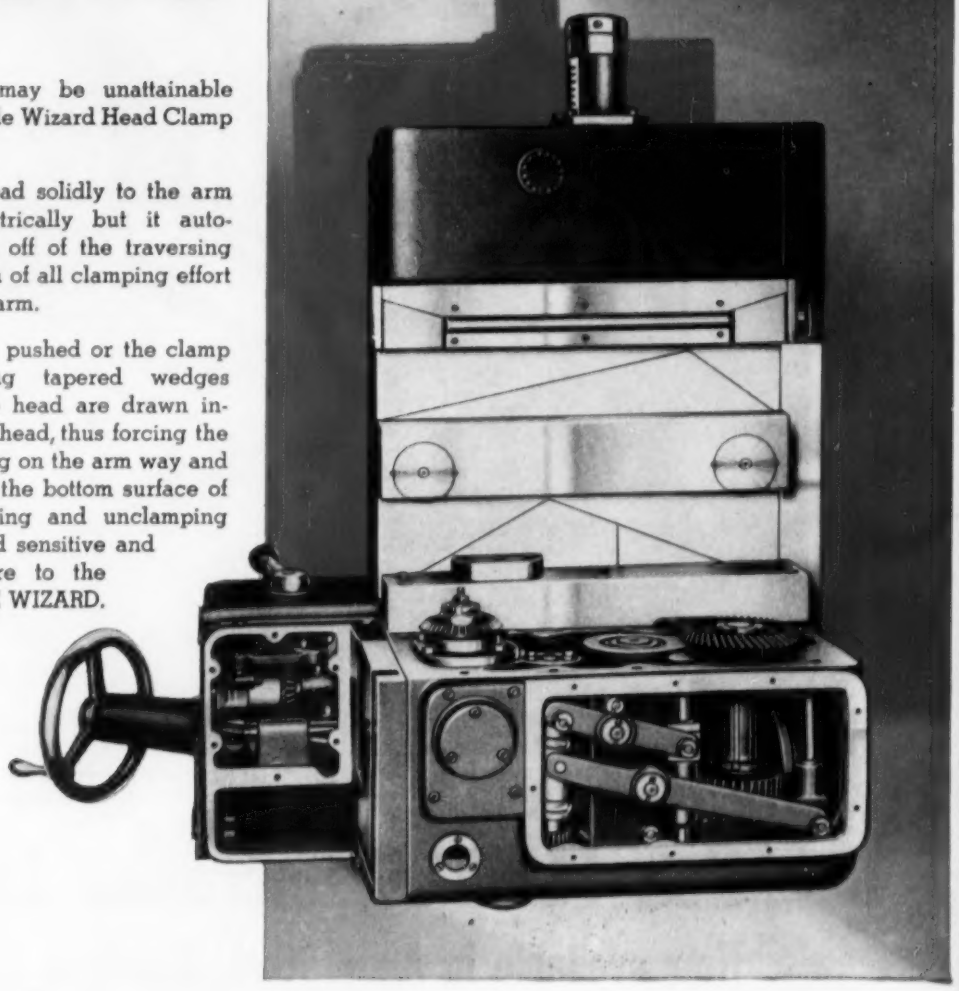
Osborn Brushes

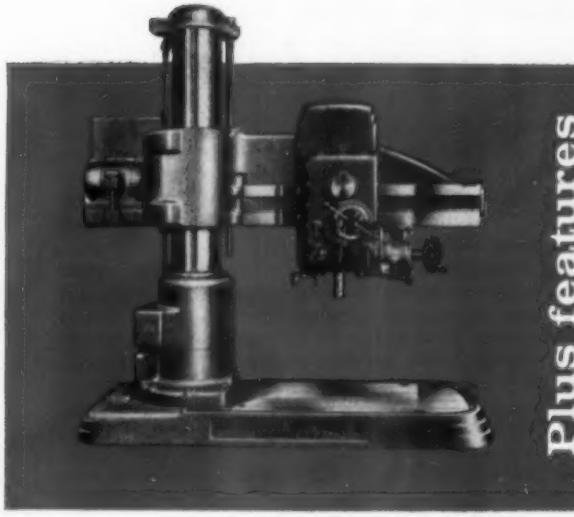
Clamping Perfection

Theoretically perfection may be unattainable but practically the new Hole Wizard Head Clamp is perfect.

It not only clamps the head solidly to the arm either manually or electrically but it automatically raises the head off of the traversing rollers, thus relieving them of all clamping effort and binds it solidly to the arm.

When the clamp button is pushed or the clamp lever actuated, opposing tapered wedges between the arm and the head are drawn inwardly at each side of the head, thus forcing the head off of its roller bearing on the arm way and wedging it solidly against the bottom surface of of the arm. This clamping and unclamping action is instantaneous and sensitive and adds another plus feature to the "AMERICAN" NEW HOLE WIZARD.





Plus features

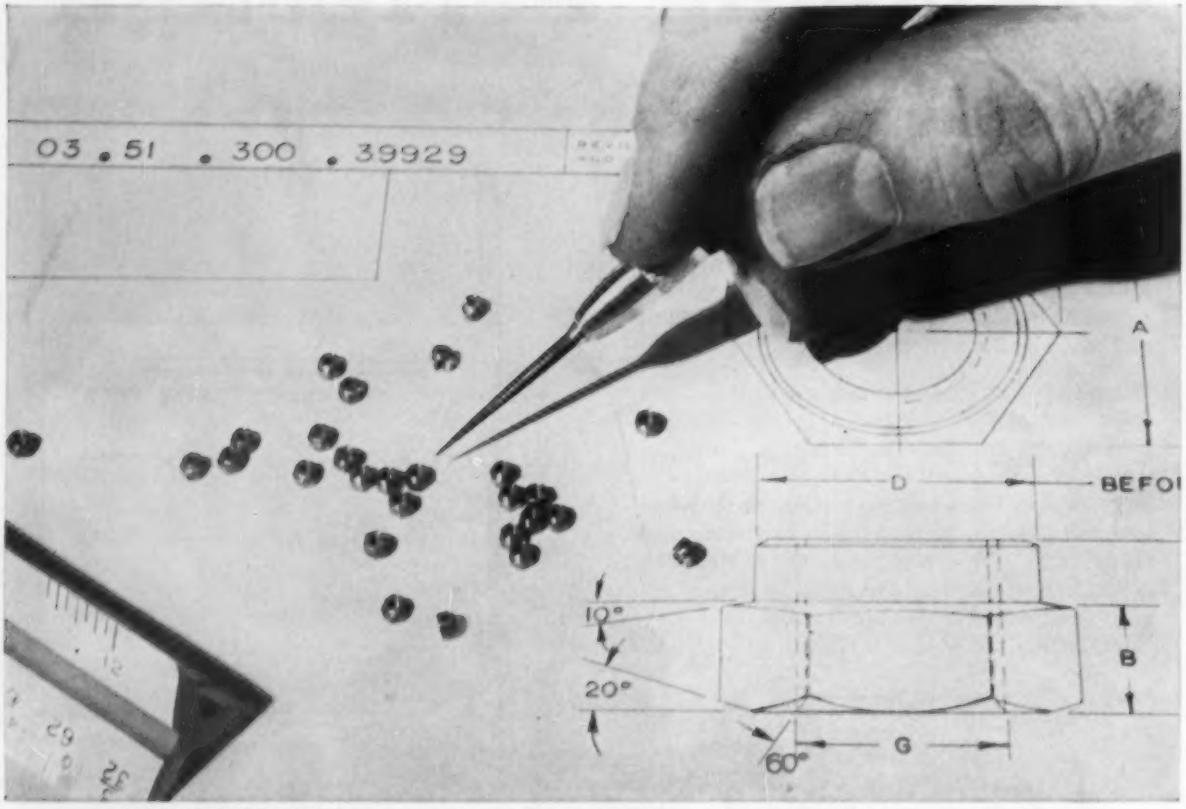
Speaking of Plus Features here are a few you will want in your next radial.

- Centralized Control.
- Lightning-fast Direct Reading Speed Change.
- Nitrided Spindle and Sleeve—practically wear proof.
- Timken mounted column unit defies deflection.
- Raybestos covered, spring steel tapping attachment friction bands, quick acting, wear proof, permitting 40% speed-up for spindle reverse.

These are just a few . . .
learn the others from bulletin No. 328

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



FLEXLOC MICROSIZE locknuts meet designers' needs for tiny precision nuts that retain strength and holding power in the smallest assemblies—servomechanisms, electronic and electrical equipment, all miniature devices.

New FLEXLOC Microsize Locknuts

Now available in Alloy Steel, Stainless Steel, Brass and Aluminum for lighter, more compact designs

SIZE	Across Flats		Shoulder Height		Across Corners	Height +.000 −.003
	MAX.	MIN.	MAX.	MIN.	MIN.	
0-80 NF-3B	.111	.107	.047	.042	.123	.075
1-64 NC-3B	.127	.123	.0635	.0585	.141	.090
1-72 NF-3B	.127	.123	.0635	.0585	.141	.090
2-56 NC-3B	.158	.153	.068	.063	.176	.105
2-64 NF-3B	.158	.153	.068	.063	.176	.105
3-48 NC-3B	.190	.183	.071	.066	.210	.120
3-56 NF-3B	.190	.183	.071	.066	.210	.120
4-40 NC-3B	.190	.183	.072	.067	.210	.120
4-48 NF-3B	.190	.183	.072	.067	.210	.120

SPECIFICATIONS: Available in brass (plain or cadmium plated) and aluminum (plain or chemically treated), for temperatures to 250°F; alloy steel, 18-8 stainless, for temperatures to 550°F.

New FLEXLOC Microsize locknuts are smaller and lighter than regular FLEXLOCS of the same nominal diameter. Wrenches of smaller size are used to install them. Mating joints or flanges can be designed smaller—with no loss in strength or convenience of assembly.

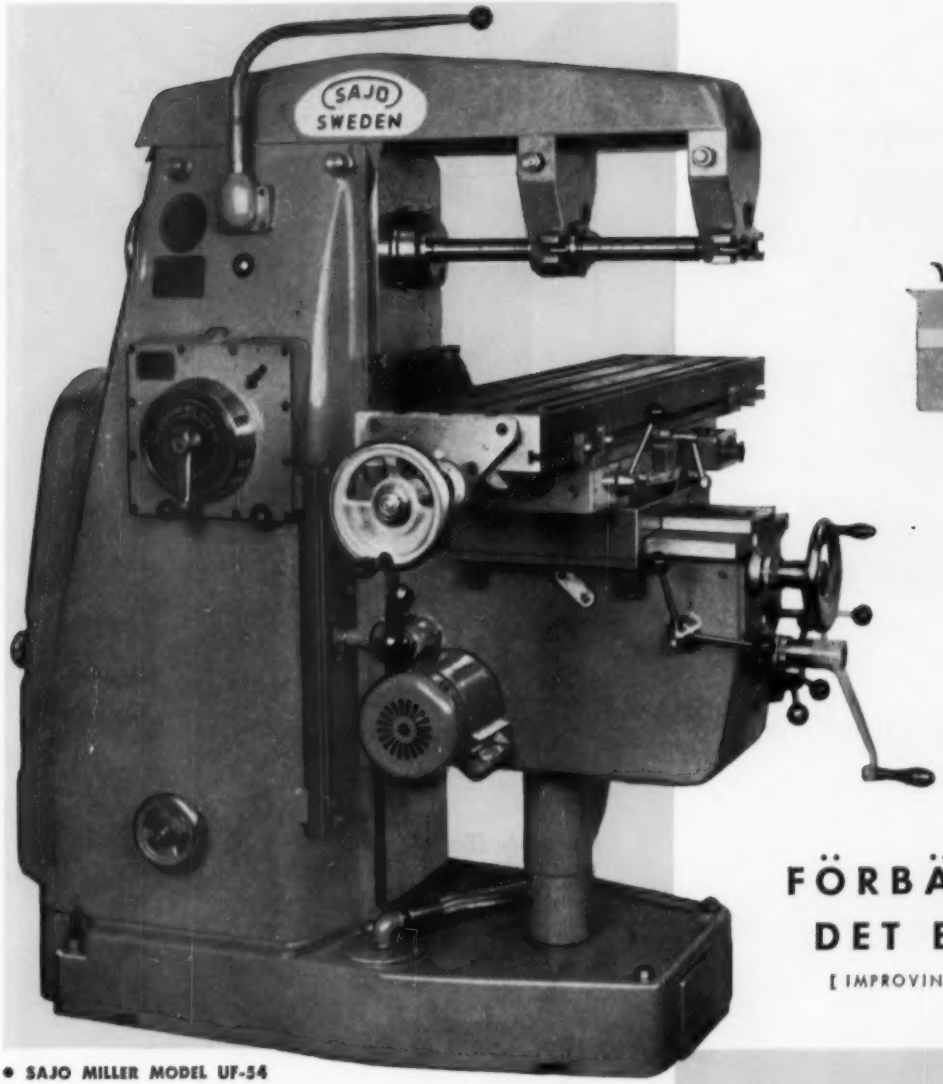
Microsize FLEXLOCS have all the advantages of larger FLEXLOCS. One-piece, all-metal construction—nothing to put together, come apart, lose or forget. Use them as lock or stop nuts—they stay put anywhere on a threaded member as soon as the locking threads are fully engaged. Uniform locking torques insure accurate preloading. There are no nonmetallic inserts to pop out or deteriorate. Moisture, dryness, oil won't affect these Microsize FLEXLOCS. Just screw them on. They lock and stay locked. Vibration won't shake them loose.

For complete information on Microsize FLEXLOCS, consult your authorized SPS distributor. Or write STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

STANDARD PRESSED STEEL CO.

FLEXLOC® LOCKNUT DIVISION SPS

JENKINTOWN PENNSYLVANIA



FÖRBÄTTRAR DET BÄSTA

[IMPROVING THE BEST]

• SAJO MILLER MODEL UF-54

High quality standards change only to become more exacting. The SAJO Milling Machines exemplify modern precision perfection in Swedish craftsmanship.

SAJO builds for accuracy to tenths and dependability that assures profitable production. Built to U.S. Standards, initial cost and maintenance are considerably less than comparable first quality millers.

The SAJO Model 54 is a full No. 2 capacity ALL-GEARED Miller in Plain or Universal types with handscraped sliding surfaces, and SKF Special Precision bearings on spindle and gear shafts.

POWER

7½ HP motor for spindle (5 HP optional). 1½ HP motor for table feed and 3 direction rapid traverse.

RANGE

16 spindle speeds 39-1500 RPM (31-1200 optional), No. 50NMT spindle, 12 table feeds 1¼ to 25 inches/min. longitudinal and cross, 11/32 to 12½inches/min. vertical. Power rapid traverse, all directions. Table travel 33½" long., 10" cross, 18" vertical.

CONTROLS

Single adjustable START-STOP-BRAKE lever. Dial selection of speeds and feeds (U.S. inch calibrated) with single lever controls. Magnetic motor starter.

FOR INFORMATION, CATALOGS, AND REFERENCE DATA, WRITE

austin INDUSTRIAL CORPORATION

76F MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL . . . YOUR FULL GUARANTEE OF SATISFACTION

a hole here makes waste...

a hole here saves waste

Crucible Hollow Tool Steels save waste — time and money — whenever you need ring-shaped parts or tools with a center hole. For the hole is in the piece when you get it! You eliminate drilling, boring, rough-facing operations — save machine capacity for productive work.

And you can get Crucible Hollow Tool Steels in *any* of our famous tool steel grades . . . in bar lengths or saw cut to your individual requirements. They are made in practically any combination of O.D. and I.D. sizes. What's more, delivery is *immediate* with Crucible's popular KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot work tool steel grades from warehouse stocks.

Next time you have an application with a center hole, let your Crucible representative show you how these hollow tool steel bars can save you money and time. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

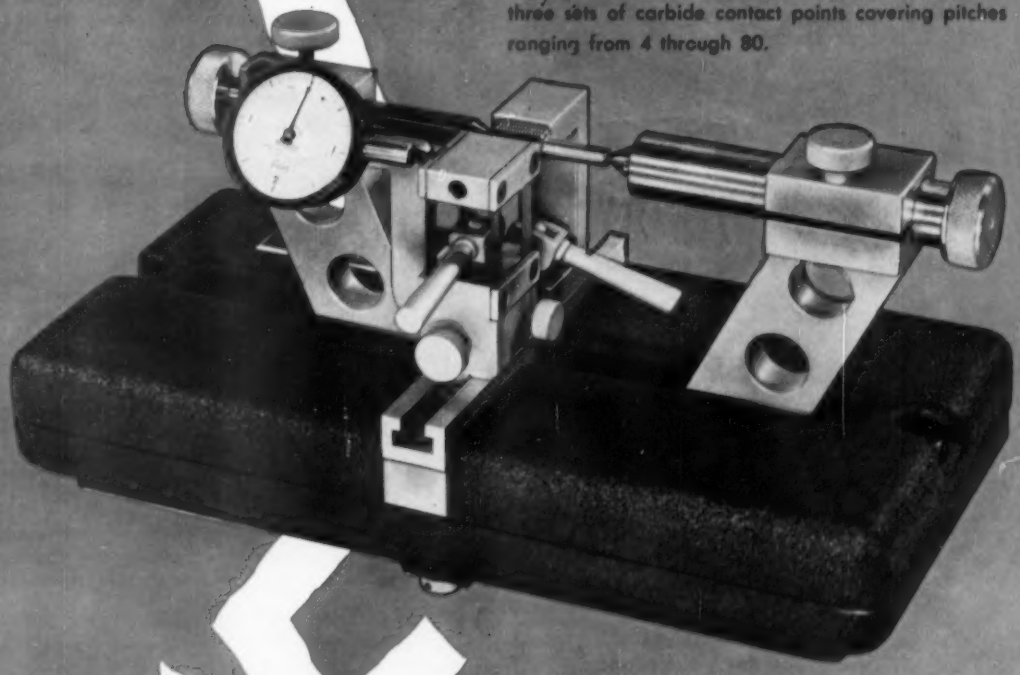
Crucible Steel Company of America

Canadian Distributor — Railway & Power Engineering Corp., Ltd.

NEW!
DRUNKEN THREAD CHECKER

Now, with the PMCo Drunken Thread Checker, it is possible to accurately check another element—"drunken threads." This new instrument, developed after many years of study, is manufactured of the finest materials, by a team of expert craftsmen. It simplifies accurate reading of helix deviation.

The PMCo Drunken Thread Checker has a capacity up to 3¼" diameter. Maximum measuring distance between centers is 5⅝". It is furnished complete with three sets of carbide contact points covering pitches ranging from 4 through 80.



THE PIPE MACHINERY CO.
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

Today Get the Pipe Machinery Co. "Drunken Thread Checker" Pamphlet #1. Fill in this coupon.

Name _____
Company _____ Title _____
Address _____
City _____ Zone _____ State _____

THE DIMENSIONAIR

The One-Master Air Gage.
Features that make it *the* Air Gage for your plant

Stable,

1 **One master, only, required.**

2 **Constant, positive accuracy.** Its balanced air system is positively controlled — its accuracy built in. It can't drift.

3 **Dependable stability.** Unaffected by surges, or changes in air pressure.

4 **Linear, direct reading scale.** Not a "go" and "no go" gage. Its positively controlled accuracy permits a calibrated linear scale having graduations of *known value.*

5 **Longer range per magnification** .003" and .0015", on 2,500 to 1 and 5,000 to 1 respectively, take care of 90% of gaging requirements and provide the following advantages:

Greater Plug clearance makes easier and faster application of gage heads to work. More foolproof . . . less wear.

Longer approach range. Operator sees how he's doing before workpiece dimension reaches the required size, eliminating scrap.

Longer gage head wear. Greater range and clearance enable gage heads to wear longer. Gage heads easily refinished.

Greater jet protection. Lower jets protected from damage.

6 **Fast, easy setting.** Positive setting in ten seconds. No fiddling around balancing air pressure.

7 **Easiest to install.** Connect directly to air supply. Filter already attached. Pressure regulator which assures ample protection is built in — only 40 lbs. pressure required.

8 **Less maintenance.** Gage system better protected, larger jets stay clean. Maintenance is negligible if gage is installed properly.

9 **Easily adaptable to special requirements** and combined with electrical and electronic units for *automatic gaging and machine control.*

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

CANNOT DRIFT*

Constant Accuracy

This air gage system *is basically different from that of other air gages.* It employs a *balanced air system.* One side of this system — the measuring side — is *rigidly fixed.* There is no adjustment and measurements *cannot vary.* Hence, the gage *is linear* over its long range and *can be calibrated* and *set with a single master.* Because of this, the Dimensionair is an air gage of dependable stability. *It cannot drift . . . throughout its long range.* In these ways the Dimensionair is different from gages requiring two masters.

The balancing side of the system has a *single* zero adjustment. This enables you to set the Dimensionair positively and instantly to zero, *with a single master,* as you do a Dial Indicator, Micro-Electric Meter, Electronic Comparator or other precision measuring instrument. Excess bits of dirt, oil or water *do not* affect the Dimensionair any more than they do other air gages. *But,* some gages are too *insensitive* to show up such failure.

If you are familiar with ordinary air gages requiring two masters, you'll appreciate the advantages of using *one* master. You *save half the cost of masters* and you set the gage as easily and simply as you set your watch. Moreover, you will experience, for the first time, a confident feeling of *dependable, non-drifting,* precise measuring.

The Dimensionair's basic system enables it to be *combined directly* with electrical and electronic units as used with *Machine Control* and *Automatic Sorting* Gages. This makes unnecessary the accessory equipment required by other air gages and permits higher speeds, greater precision—with assured stability. It is much easier to set the gage to the spread between electrical contacts; e.g. the spread between the machine's fine feed and the finish feed. Adjusting to zero *does not* affect this spread setting.

Why not find out for yourself the importance of these facts? Ask to have a Dimensionair put in your plant so you can try it with your own personnel. *Compare it with any other air gage* you may already own or any you may wish to have brought in for comparison.

FEDERAL PRODUCTS CORPORATION

61210 EDDY STREET • PROVIDENCE 1, RHODE ISLAND

*Not guaranteed against faulty air supply or changes in size of gage plugs or rings due to temperature.

Federal's solution to the cost of gaging:
Impartial Gage Selection
Engineering Follow-Through
Everything In Gages

mail coupon today

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61210 Eddy Street, Providence 1, R. I.

We'd like to test a Dimensionair in our plant.

SEE ALSO NEXT PAGES

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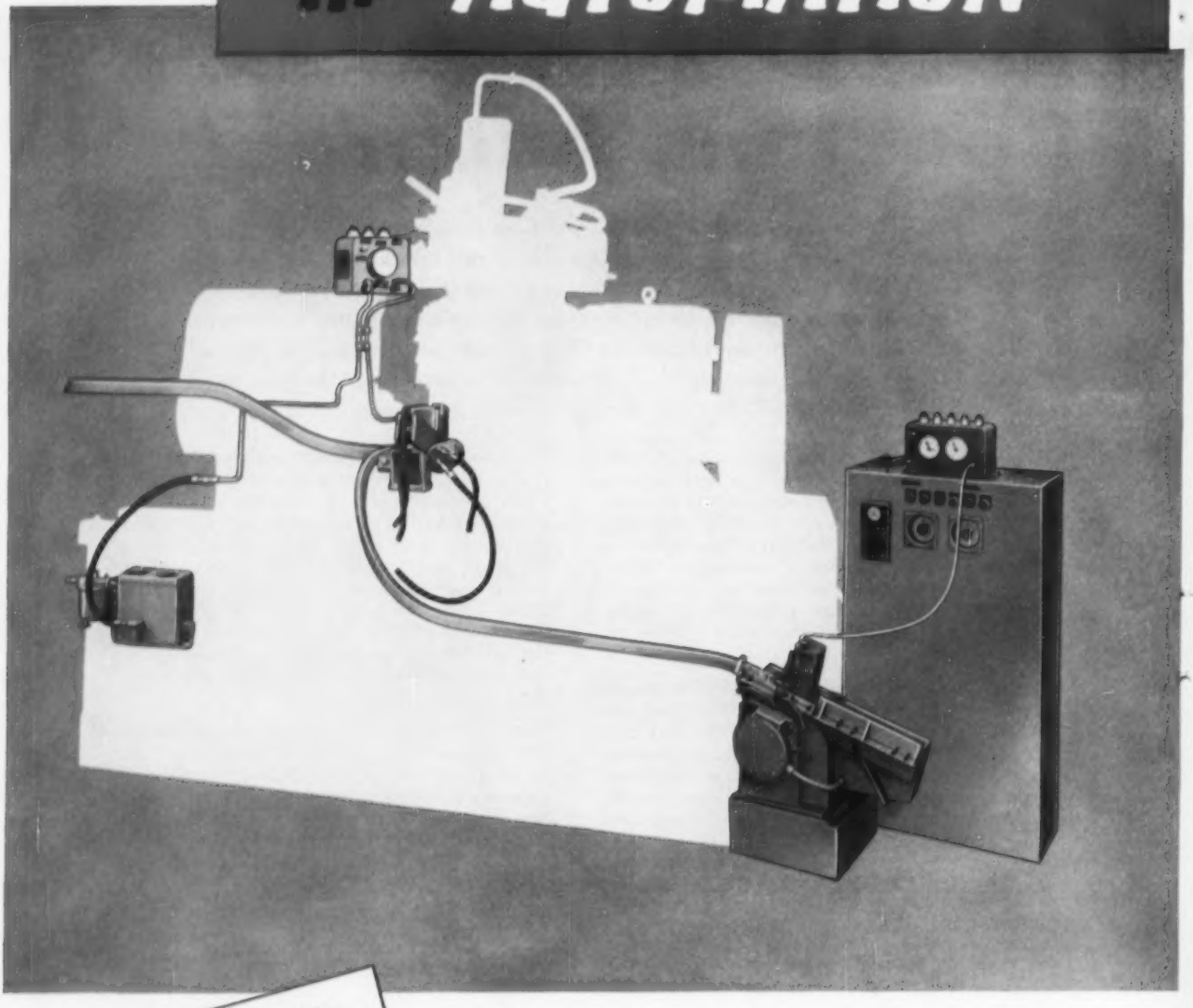
In AUTOMATION



Federal's Solution to the Cost of Gaging . . .
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Combined Gaging permits close control of work size over long periods of time. To compensate for drift, etc., gage on the machine shifts its control point at the command of the after-gage (lower right) which originates signal when a prescribed number of pieces has exceeded marginal limits.

SEE ALSO PRECEDING PAGES

Ask FEDERAL First

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Gaging, too,

FEDERAL goes the whole way

If you're ready to talk about . . .

Control on the Machine
Control after the Machine
Combined Gaging
Control for Non-Reference Variation
Control of Size for Predetermined Fit
Continuous Process Control
Control Point Compensation
Flagging Gages
Chute Gages

or other types and methods of automation gaging—

Automation has become a byword in plants today. It's easy to look upon Automation as the answer to every production problem. Being the first to treat Automatic Gaging so fully, however, we are well aware how helpful experienced advice can be in avoiding the mistakes and disappointments which often occur when complete automation is undertaken with *insufficient knowledge and too hasty planning.*

Close cooperation with machine tool builders has enabled us to successfully develop gages that conform to the capabilities of their machines. Our engineers provide various degrees of control on existing machines in the field and also work in close collaboration with machine designers to provide gaging and control units built into the manufacturer's original machines.

Many highly successful installations in daily operation demonstrate our practical knowledge in this field of gaging. We will welcome the opportunity to discuss your proposed automation when you first start your preliminary planning.

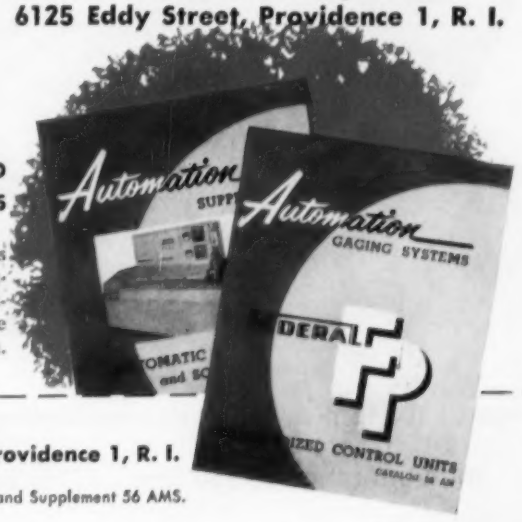
Our goal is the development of the one best automation gage for your job using mechanical, air, electric, or electronic gaging systems, whichever suits your needs best. Write or call us today.

Federal Products Corporation
6125 Eddy Street, Providence 1, R. I.

NEW

AUTOMATION CATALOG 56 AM AND SUPPLEMENT 56 AMS

Include many photographs and diagrams showing automatic gaging and sorting systems successfully employed in various industries. Full of valuable ideas — these are important reference books. Ask for them.



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Send Automation Catalog 56 AM and Supplement 56 AMS.

Name ..... *Title* .....

Company Name .....

Address .....

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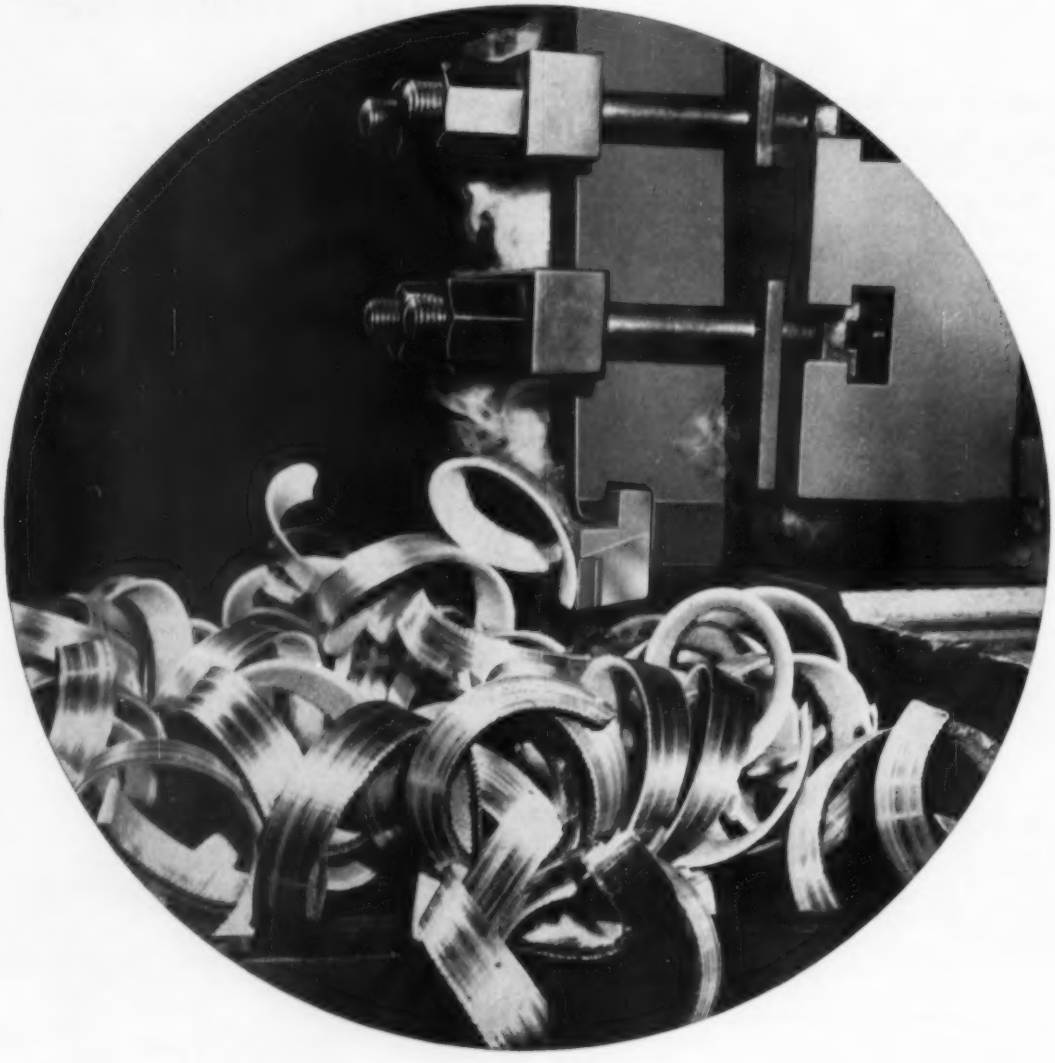
speeds for carbides **plus** heavy-cut efficiency



low range to 100 fpm . . . for extreme depths of cut and maximum feeds

medium range to 150 fpm . . . for average cuts in medium steel or cast iron

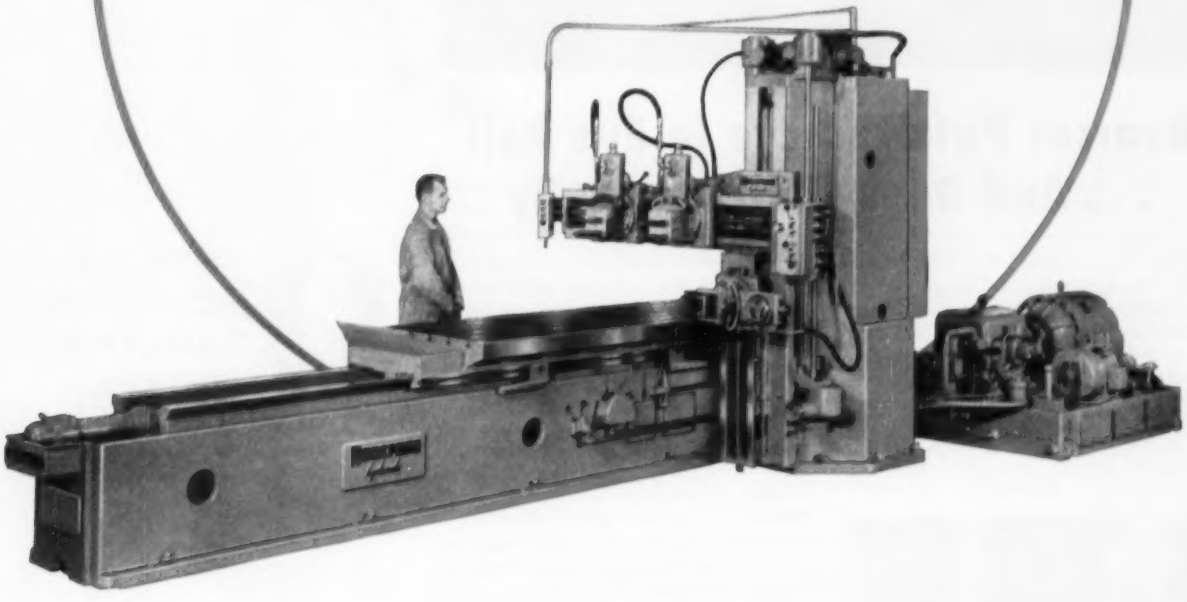
high range to 300 fpm . . . for carbide planing of steel and non-ferrous metals

with triple circuit h3 drive

The new heavy duty Model OGN Hydraulic Shaper-Planers are equipped with triple circuit h3 drive to combine the ruggedness and cutting efficiency of single circuit planers, with the speeds required for carbide planing. Three distinct ranges of cutting speed are provided, with power inversely proportional, to give the correct combination of speed and force to most economically machine any metal.

Hydraulic drive is ideally suited for carbide tooling, since optimum cutting speeds can instantly be set for any tool. Tools also enter the cut more smoothly with hydraulic drive to reduce the tendency for fracturing brittle carbide tips.

A Rockford Machine Tool Co. representative can demonstrate these advantages for you. Ask your local dealer for full details, or write us for a copy of Bulletin No. 1200.



ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

h HYDRAULIC

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Bearcat Puts the Eye in Eye Bolt . . . And Does It Economically

Putting the eye in an eye bolt is one thing, but doing it quickly, accurately and economically on thousands of pieces is something else again. J. H. Williams & Co., Buffalo, who make wrenches, tools and drop-forgings, changed to Bearcat for the punching operation shown here. They found that because of Bearcat's fine wear-resistance and shock-resistance, the punch provided a service life about 50 pct longer than the one previously used.

The Bearcat punch, hardened to Rockwell C 56-58, works on steel stock ⅛ in. and 5/16 in. thick, and knocks out discs approximately ¾ in. in diameter. About 0.020 in. to 0.040 in. is removed in occasional redressing.

Bearcat is our super-tough, air-hardening, general-purpose grade of tool steel. It is perhaps best known for its exceptional resistance to shock and wear. Besides, its air-hardening characteristic minimizes quenching hazards, and also provides excellent resistance to distortion in heat-treatment.

Bearcat has a wide range of tough applications, too. In addition to its use in punches, it's a natural for rivet sets, chisels, gripper dies and hot-headers. It is also ideal for master hobs, and for dies used in blanking, bending, and cold-forming.

Your local tool steel distributor has a stock of Bearcat, and chances are good that he can furnish exactly what you need. Call him now, while you have it in mind.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Choosing the Grade Means More Than Naming the Tool

Let's say you have a general tool-and-die application, for which you are to select the proper grade of tool steel. How do you go about it? Obviously, it is not enough to know that the customer wants high hardness and good wear-resistance, for these properties are always required, in some degree. What you need are the answers to the following questions:

1. How is the tool to be made?
2. How is it to be used? Blanking? Forming? Cutting?
3. How is the steel to be heat-treated?
4. Are machinability and wear-resistance important?
5. How close must size be held after heat-treatment?
6. What is the previous experience with this job? Which steels were used and what results were obtained?

Selecting tool steel grades, even when you want perfection of operation, isn't too hard when sufficient data is available. But without adequate information, you may find your selection is disappointing.

TOOL STEEL MOVIE WINS ANOTHER AWARD

Bethlehem's tool steel color movie, "Teamwork," an award winner at film festivals at Columbus and Chicago, recently won a Certificate of Merit at the Cleveland Film Festival.

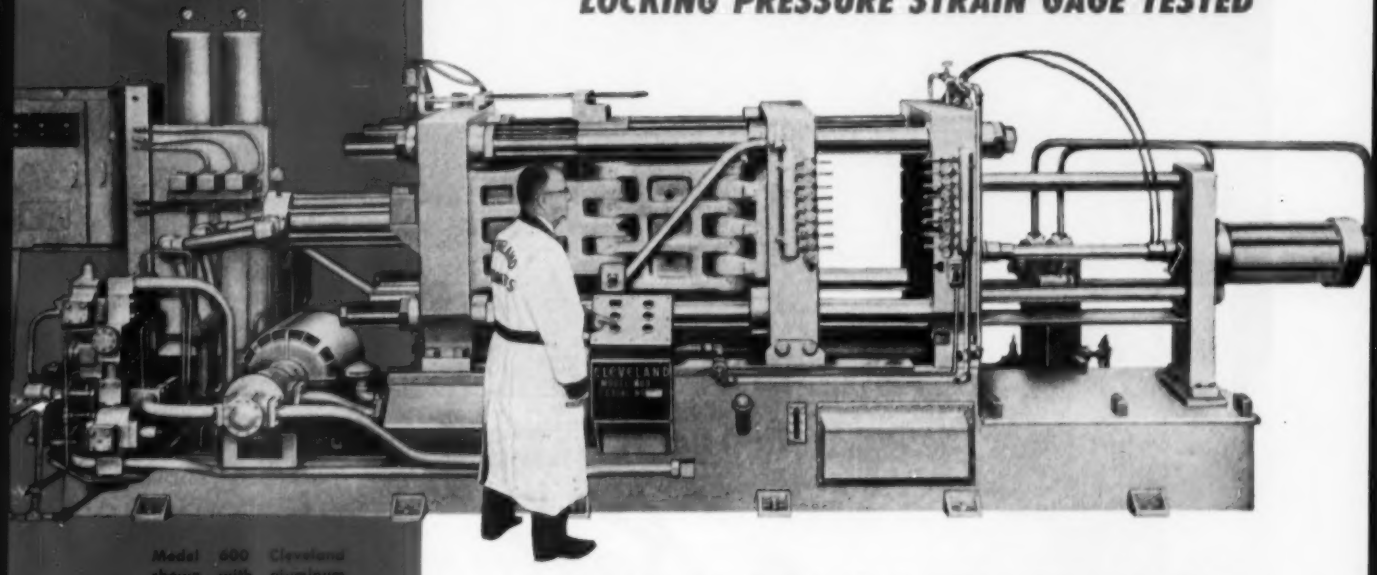
The 16-mm, 30-minute picture explains the quality control and heat-treatment of Bethlehem tool steel, and shows typical applications of the carbon, oil- and air-hardening, shock-resisting, hot-work, and high-speed grades.

It's excellent for showing to heat-treaters, die-makers, machinists and machine-tool manufacturers, as well as to technical societies and engineering students. If you would like to schedule a showing of "Teamwork," send your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.

MODEL **600** **GREATEST CLEVELAND YET!**

New 600-Ton Universal Hydraulic Die Casting Machine

LOCKING PRESSURE STRAIN GAGE TESTED



Model 600 Cleveland shown with aluminum shot end. Also available as a hot chamber machine. Has 46½" x 46" die plates; 28" x 28" space between tie bars; 20" max.—10" min. die thickness; 8"-15" die opening.

You're looking at the finest 600-ton die casting machine available today! The new Model 600 Cleveland was designed in every detail to give the die casting industry a machine of exceptional performance capabilities . . . high speed, reliable operation . . . safe and simple control . . . minimum maintenance. The developed machine more than met these specifications.

This new Cleveland will deliver castings weighing up to 10 lbs. aluminum, 25 lbs. zinc. An idea of the brawn built into the design—to back up its guaranteed 600-ton locking pressure—is indicated by the 38,000 lbs. net weight of the cold chamber machine shown above. Massive toggle system, 5" dia. tie bars and cross head guide bars, 7¾" thick platens, insure rigidity and accurate die alignment.

The hydraulic system is practically as leak-proof as can be built. Manifold valving is incorporated. Total pump capacity is 99 gpm. A 200 gal. oil reservoir is provided. Filter capacity is twice pump capacity. Two accumulators provide high injection speed.

Dozens of other highly important features—many are exclusively Cleveland's—are incorporated. You'll want to call in a Cleveland sales engineer for full details. In the meantime, factual information, well illustrated, in Bulletin 600 will give you plenty of incentive to reserve floor space for this new Cleveland in your shop. Write now for your copy.

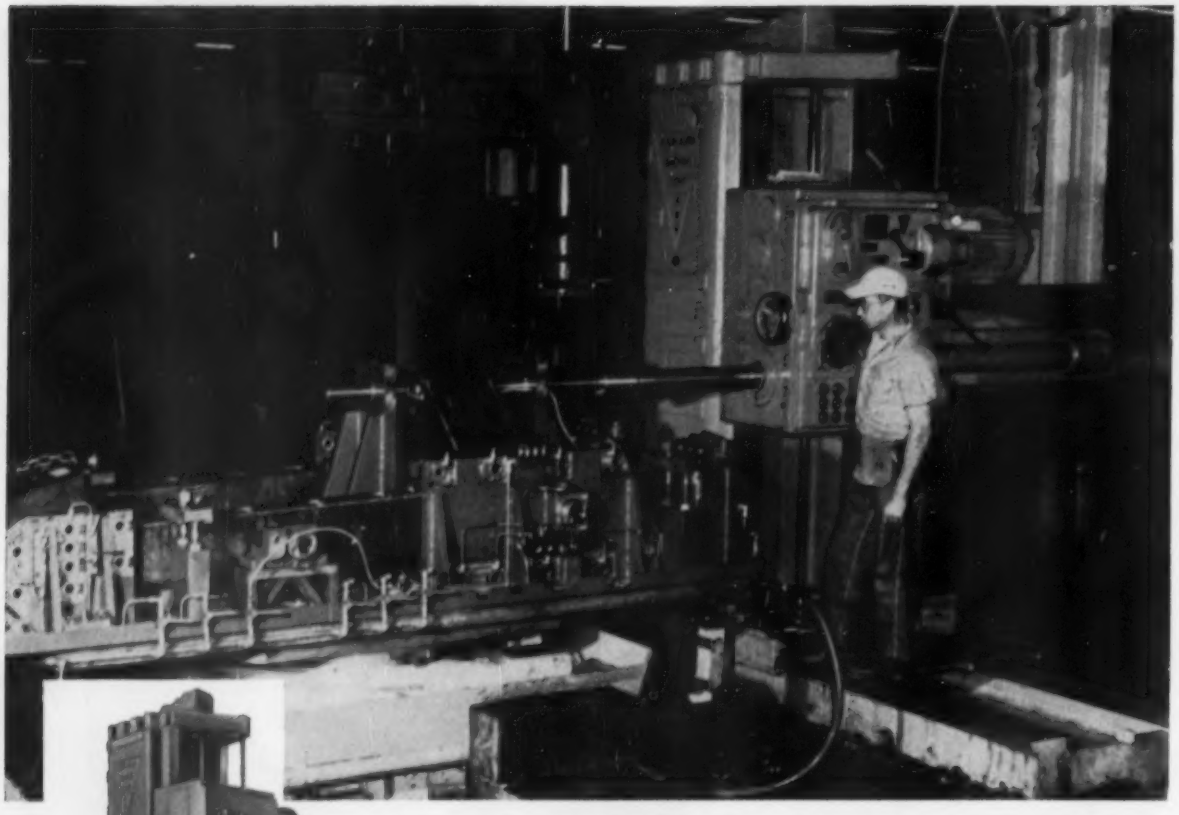
Write for Bulletin 600

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines



A JOB THAT ONLY A *Kaukauna*

HORIZONTAL DRILLING, TAPPING AND BORING MACHINE

CAN DO—*faster, easier, at lower production cost*

All four sides of the main frame for a crawler type diesel tractor are drilled and tapped, reamed or chamfered, on the Kaukauna Model 3040 Horizontal Drilling, Tapping and Boring Machine at the plant of a nationally known manufacturer of farm equipment *with one setup.*

The tractor frame is approximately 10 ft. long by 4 ft. wide and therefore the Model 3040 permits a full 110 in. travel of the column on the runway. In this setup, the tractor frame is dropped by overhead crane into a fixture on a power driven rotary table located in front of the Kaukauna and the production operation is simple, accurate and rapid:

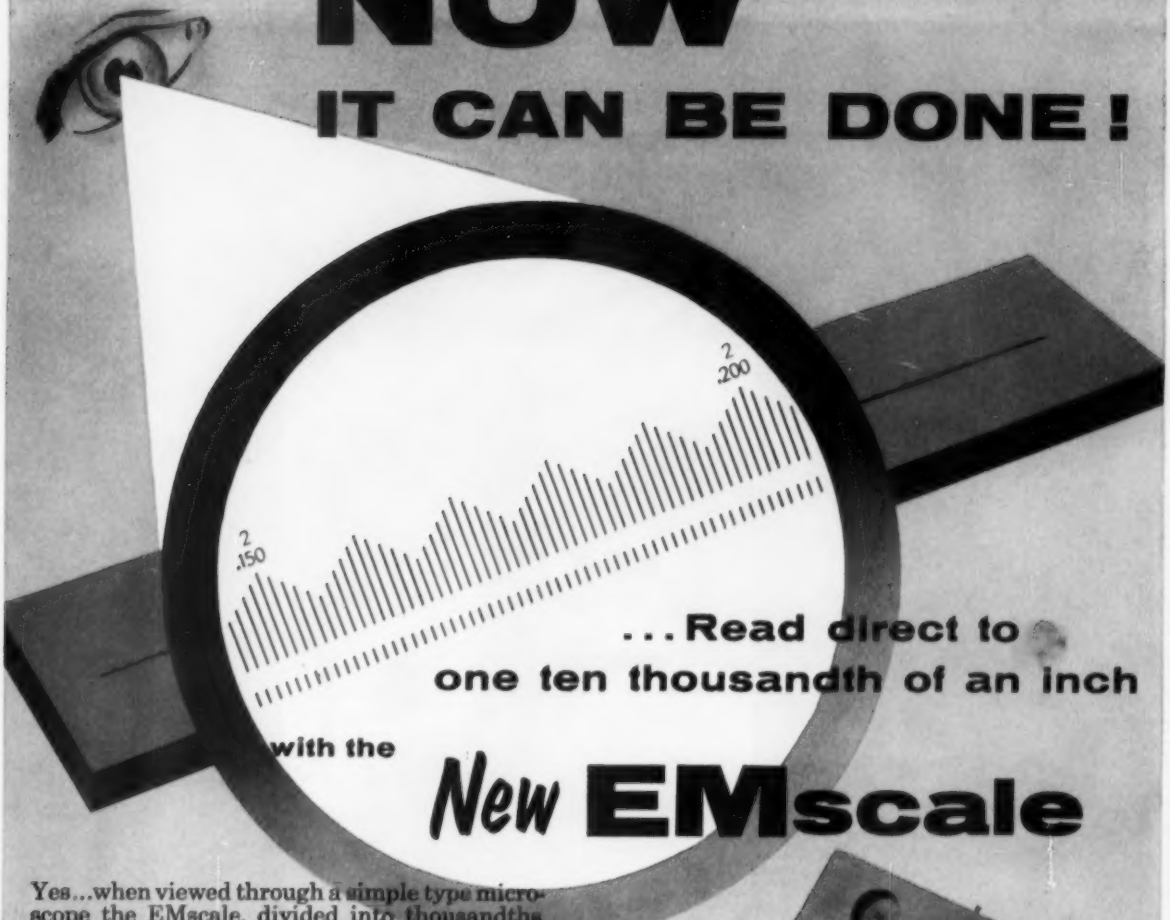
Set up frame in fixture.
Drill, Tap and Chamfer sixteen holes.
Index table 90° to second side.
Drill, Chamfer and Tap six holes.
Index table 90° to third side.
Drill sixteen holes; drill and ream two dowel holes.
Index table 90° to fourth side.
Drill, Chamfer and Tap six holes.
Remove frame from fixture.

Convenient push button controls for complete machine operation are located at the front of the headstock. The unusual 42" spindle travel eliminates any need for tool extensions and insures maximum tool rigidity. Operator working conditions are ideal because the usual pit or platform is not necessary and crane time is kept to an absolute minimum.

Learn now what a Kaukauna will do for you by time estimates on your various jobs. Consult your nearest Kaukauna distributor, or phone, wire or write direct.

KAUKAUNA MACHINE & FOUNDRY DIVISION
GIDDINGS & LEWIS MACHINE TOOL COMPANY
KAUKAUNA, WISCONSIN, U.S.A. TELEPHONE ROCKWELL 6-4631 CABLE KAUMACH

NOW
IT CAN BE DONE!



...Read direct to one ten thousandth of an inch with the

New EMscale

Yes...when viewed through a simple type microscope the EMscale, divided into thousandths of an inch appears as shown above. By equipping the microscope with a vernier eyepiece, readings of 1/10,000 of an inch (.0001") can be made...quickly, easily, accurately. The EMscale is numbered at every fifty thousandth. Two sets of figures are always in view indicating correct direction of movement.

EMscales can be used wherever measurements must be read to three and four decimal places. Use them on milling machines, horizontal borers...with a traveling microscope for accurate map measuring. A machine with a worn leadscrew can be put back into useful service by the addition of an EMscale.

To avoid the worries of troublesome thermal expansion problems, EMscales can be made of the same material as the work being measured.

Let us send you the complete story. Mail coupon below.

EMscale mounted in holder with aligning screws and case.

OPTICAL MEASURING DEVICES

ELLIOTT-MYERS Corporation

51 Hammond Road Warren, Pennsylvania

Elliott-Myers Corporation
50 Hammond Road
Warren, Pennsylvania

Please send me complete information on EMscales.

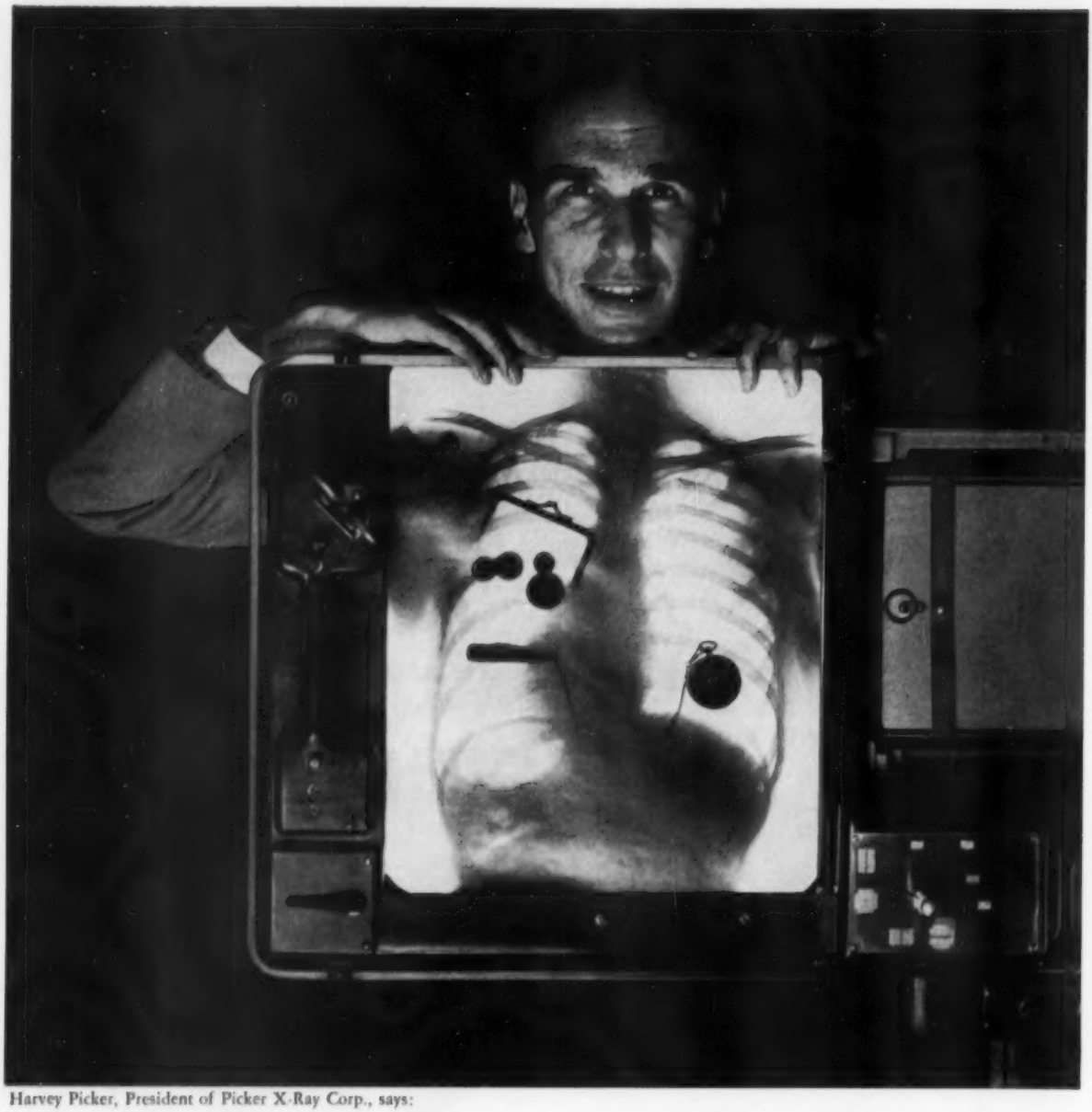
Name.....

Title.....

Company.....

Address.....

City.....Zone.....State.....



Harvey Picker, President of Picker X-Ray Corp., says:

"Here's an inside story on Picker X-Ray!"

"You're looking into two important ingredients of Picker success — time and money.

"Time is essential when a hospital's X-ray equipment needs a replacement part. There are thousands of parts which no one could afford to stock-pile everywhere in the country.

"What happens? They call the nearest Picker office and the order is relayed to Cleveland, our manufacturing center. Whatever's needed always gets there — and fast!

"How? By Air Express!

"But still, money is a consideration. With Air Express service — including delivery to the door — most of our shipments cost less than any other air service. 15 lbs., for instance, Cleveland to Milwaukee is $3.23. It's the lowest-priced complete air-shipping service by $4.02!"

Air Express

GETS THERE FIRST *via U.S. Scheduled Airlines*

CALL AIR EXPRESS . . . *division of* RAILWAY EXPRESS AGENCY

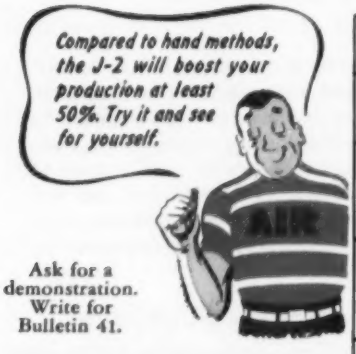
Speed up the job with the –

NEW ROTOR IMPACT WRENCH

FAST. Powerful air tool. 2100 solid blows per minute set nuts in a hurry. Reversible for removing nuts.

NON-FATIGUING. Weighs only 3 lbs. Well balanced. No stalling shock. No twist.

LOW MAINTENANCE. Fewer parts . . . some interchangeable . . . some reversible. Steel clutch housing. Rugged throughout.



Ask for a demonstration. Write for Bulletin 41.

SPECIFICATIONS

MODELS	Blows per Minute	Length	Weight	Square Drive*	Side to Center	Hose Connection	Rated Capacity, (Bolt Size)
J-2-S Side Handle	2100	6"	3#	½"	1⅛"	¼"	¼"
J-2-L Lever Handle	2100	7¾"	3¼#	½"	1⅛"	¼"	¼"

*⅜" square drive or ⅞" Quick-Change Chuck is optional.

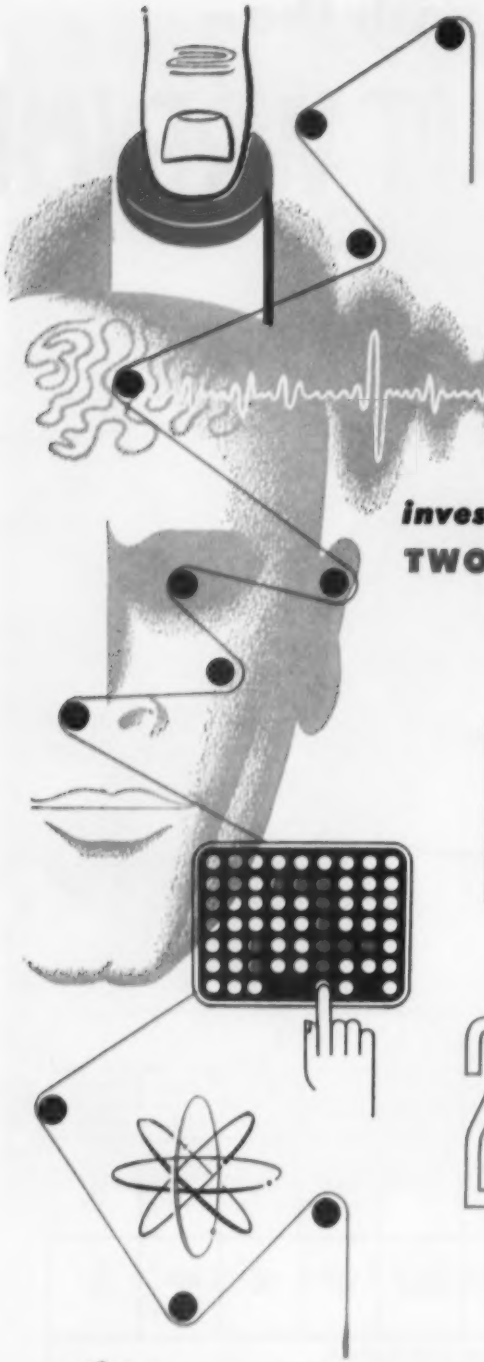
AIR

HIGH CYCLE

THE ROTOR TOOL CO.

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



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1 ENGINEERING COMPLETE PRODUCTION-LINE SYSTEMS

Complete service includes planning step-by-step sequence of operations and the individual engineering of processes, methods and equipment to meet your production needs. Barnes' creative engineering, developed over a period of 80 years in designing and building high production machine tools, can be depended upon to provide you with the latest in cost-cutting methods. Our highly versatile engineering staff will work with you as a team to solve problems quickly and efficiently.

2 DESIGNING AND BUILDING SPECIAL UNITS

To meet specific work-handling or processing needs, Barnes' engineers have designed and built special conveyors, turn-over mechanisms, inspection, and assembling equipment to suit either automatic or semi-automatic requirements. Hundreds of units are today profitably serving a wide range of industries. Because electrical, hydraulic, mechanical, tool and fixture engineering is closely coordinated at Barnes under one roof, you save time and eliminate divided responsibility.

Write for Free Literature

Ask for Production Analysis

Find out today why more and more production executives are turning to Barnes for help with their automation problems. Barnes' creative engineering staff will be pleased to analyze your requirements, offer recommendations, and provide you with a cost estimate in a formal proposal, if you desire.

Builders of Better Machines and Equipment since 1872

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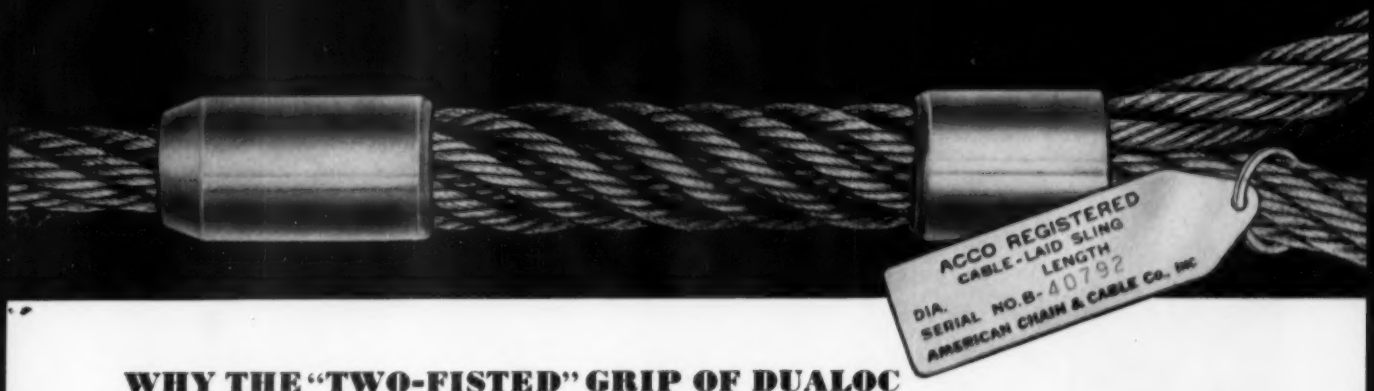
AUTOMATION SECTION

413 S. WATER ST. • ROCKFORD, ILLINOIS

SPECIAL MULTIPLE SPINDLE MACHINE TOOLS • SPECIAL PROCESS EQUIPMENT • SPECIAL ELECTRICAL CONTROLS

ACCO

Dualoc



WHY THE "TWO-FISTED" GRIP OF DUALOC IS IMPORTANT TO YOU...

WHEN YOU BUY SLINGS with ACCO'S DUALOC ENDING, instantly identified by its two buttons, you get

...the safest, most modern, most exact lifting tools made from wire rope

...slings with UNITIZED CONSTRUCTION—with full wire rope strength in all parts

...the maximum protection against damage from sling failure for your men, machines and materials

DUALOC IS A UNIQUE ENDING

DUALOC is the only real mechanical ending. There is absolutely no loss of strength through the crushing of wire rope—necessarily present in all "compression" endings, where the loop is formed by simply pressing on a collar.

With DUALOC, the load carrying or "standing" end of the sling is not disturbed in any way. This eliminates the weakening effects of distortion in hand-splicing operations. And there are no harmful effects from heat or acids which weaken zinced sockets.

ONLY WITH DUALOC DO YOU GET COMPLETE MECHANICAL HOLDING

In DUALOC the strands of the dead-end are wrapped around the load carrying end of the wire rope in such a manner that they bind against it.

These wrapped ends have a self-snubbing action which mechanically grips tighter as the load on the sling is increased. This means that the collars are actually under less load when lifting than when the sling is hanging free.

These features are so unique and so important that they have been fully protected under U.S. Patent number 2463199 and additional patents in other countries.

ONLY WITH DUALOC CAN YOU HAVE THE SAFEST WIRE ROPE SLINGS MADE

Only with DUALOC is it possible to obtain from Wire Rope slings the dependability, uniform strength, and consistent performance required under ACCO Registry.

Get the complete story on the DUALOC ENDING and what it means in extra safety, reliability and handling ease. Call your ACCO Registered Wire Rope Sling distributor or write our Wilkes-Barre, Pa., office for FOLDER DH-531.

ACCO

American Chain & Cable Company, Inc., Wilkes-Barre, Pa.

Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.
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ARMSTRONG

T-SLOT CLAMP

STEP BLOCK

SET-UP AND HOLD-DOWN TOOLS

ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

NON-SKID

Write for Circular

Buy ARMSTRONG TOOLS from your Industrial Distributor

PLANER JACKS

UNIVERSAL CLAMP

T-SLOT BOLTS AND NUTS

STRAP CLAMPS

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVE. CHICAGO 30, U. S. A.

Announcing!

"GRADE MARK SERVICE"

a new time-and-money-saving "extra" to users of COLD FINISHED BARS

● "GRADE MARK SERVICE" gives you quick, accurate identification.

● With strapping seal showing grade of each bundle, you save time and trouble in identifying and handling each grade. This is "Grade Mark Service." No need to separate and sort out bars—they are bundled according to grade.

● Another reason why U. S. STEEL SUPPLY is where to buy!

To simplify the identification and handling of cold finished bars . . . to make it much easier for your receiving department to properly stock incoming shipments, we have an entirely new method of bundling and marking the bars you order.

Beginning now, the cold finished bars in your order will be shipped to you in neatly strapped bundles, and each bundle will carry a seal which clearly shows the grade of the bars in that particular bundle. Thus, without altering your stocking procedure in any way, you save time and trouble in identifying and handling each grade. This is "Grade Mark Service."

This new and improved method of bundling and marking shipments of cold finished bars is another reason why it pays to buy from U. S. STEEL SUPPLY. One call is all that's needed to get the bars you want. Your order will be filled and shipments made from the warehouse nearest the point of delivery.

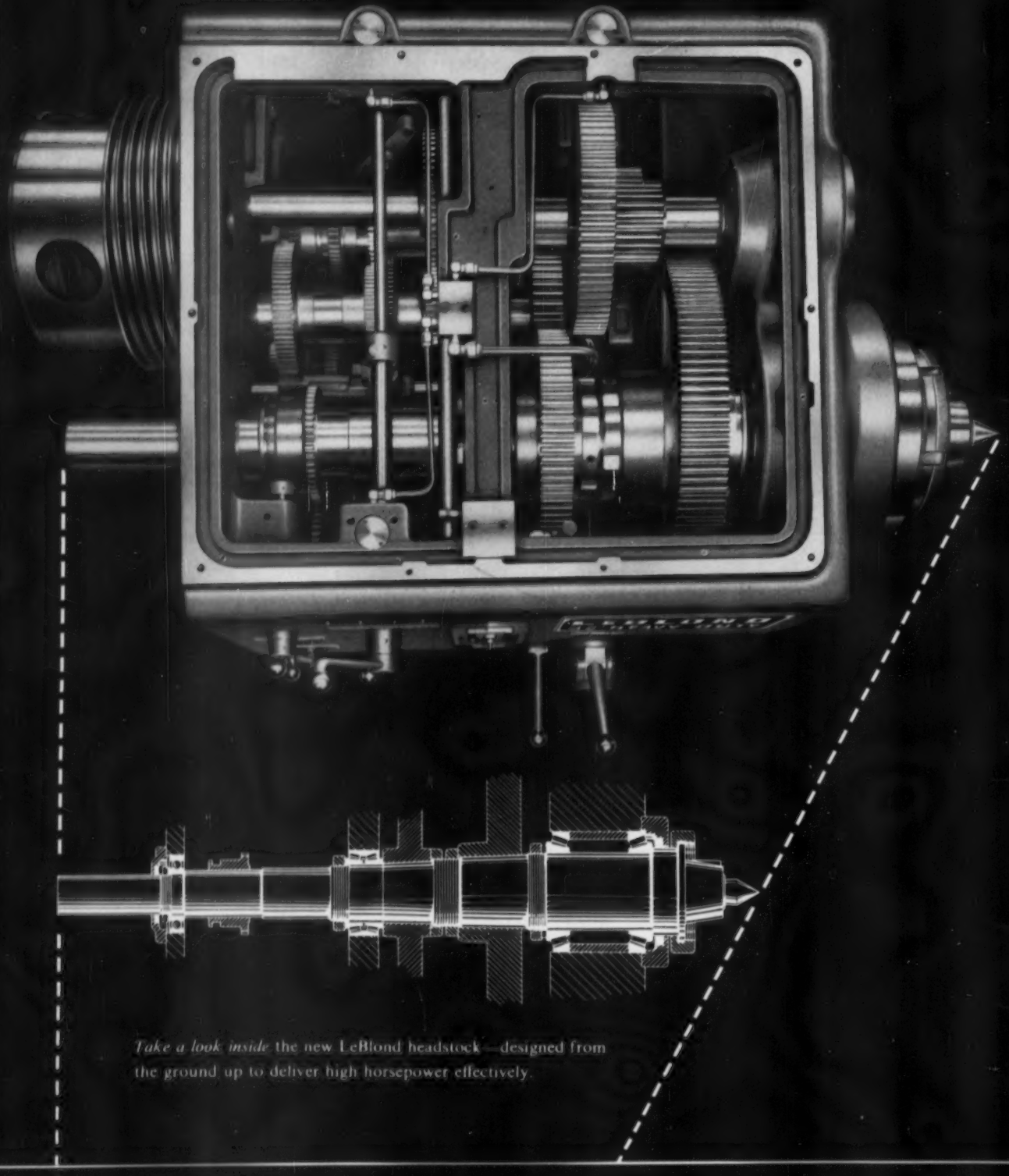
U. S. STEEL SUPPLY

DIVISION

General Offices: **208 So. La Salle St., Chicago 4, Ill.** **Warehouses and Sales Offices Coast to Coast**

UNITED STATES STEEL

Designing LeBlond lathes for



Take a look inside the new LeBlond headstock—designed from the ground up to deliver high horsepower effectively.

60-HP turning was an inside job

This new headstock is the power secret of the LeBlond 32" Heavy Duty.

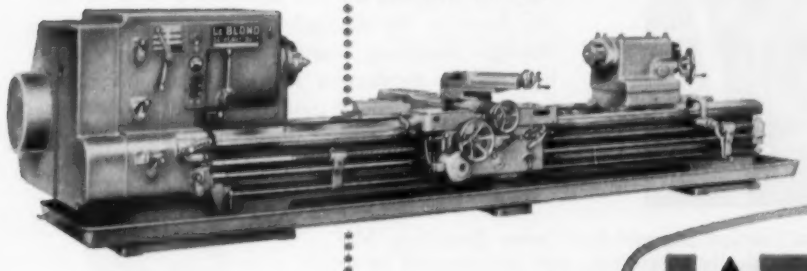
Notice how short and heavy the shafts are—to minimize deflection. Look at the fine-pitched, wide gears—for better tooth action and greater load-carrying capacity. They're hardened and ground for all speeds except low back gear. Free-running spur gear design assures minimum no-load friction horsepower. Shafts and gears not needed for a given speed remain idle, do not consume any power. The new 4-bearing spindle gives maximum rigidity, has twin Timkens at front, double-row Timken at center, ball bearing at rear.

Of all the lathes in the world, the LeBlond 32" Heavy Duty was selected by a leading manufacturer of carbide tools, to be modified for grueling laboratory tests. Using 125 hp drive, cuts were made with a measured 118 hp at the tool—*210 cubic inches of SAE 1045 removed per minute!*

Results like this call for a machine built in every detail for high-horsepower turning. The new headstock design is typical of the engineering in every element of the new LeBlond 32" Heavy Duty. The totally-enclosed quick change box, the hardened rack, 4-directional power rapid traverse, hardened and ground steel bedways, thrust-lock tailstock.

Whatever your turning needs—high power or high production, small swing or large—LeBlond makes a lathe you can trust with the job. 76 different models to choose from. Today, see your LeBlond Distributor or write—

36 speeds, new adjustable acceleration. From 4.5 to 500 rpm. New and exclusive adjustable acceleration brings heavy work pieces up to speed safely; any percentage of full torque can be selected for the first five seconds. Similar adjustments can be made for stopping and jogging, by means of three rheostatic controls to the electric clutch and electric brake. Hydra-Trace duplicating attachment optional. Write for Bulletin HD-165 for full details.



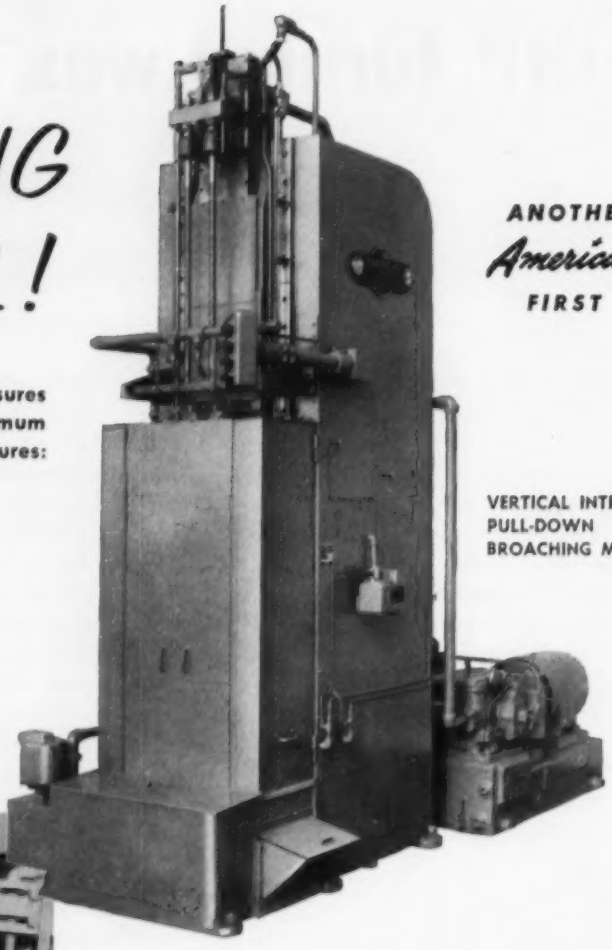
...cut with confidence

LeBLOND *of Cincinnati*

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 69 YEARS*

POSITIVE BROACHING CONTROL!



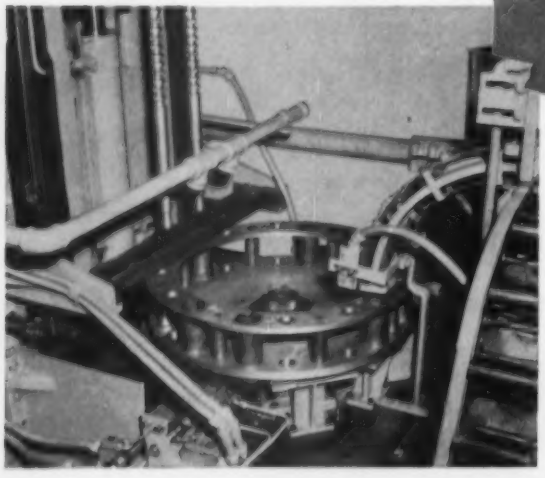
ANOTHER *American* FIRST

VERTICAL INTERNAL PULL-DOWN BROACHING MACHINE

This NEW American Pull-Down Machine assures high production internal broaching and maximum machine efficiency by these positive control features:

***NEW** retriever unit is built integral with a massive machine slide — provides continuous, rigid broach support through the major portion of the broaching stroke.*

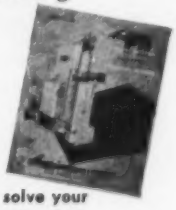
***NEW** chip-free, radially-locked puller design—insures that broaches are locked securely in position before the machine cycle can continue.*



AUTOMATION FLEXIBILITY

Illustrated at the left, the NEW American Pull-Down Machine is tooled for full automation of parts from the floor to the dial-index unit pictured, and on through broaching position to final parts ejection back to the production line. Such automatic components can be added initially or later as individual production requirements demand, and without the usual high cost of special engineering.

The NEW American Vertical Internal Pull-Down Broaching Machine is completely electrically controlled, with all elements interlocked for maximum tooling safety and machine efficiency. High speed production at constantly maintained tolerances becomes a fact through American "Engineered Production."



Write today to see how American can solve your internal broaching problem. Ask for Catalog No. 800.

AMERICAN *American* BROACH & MACHINE CO.

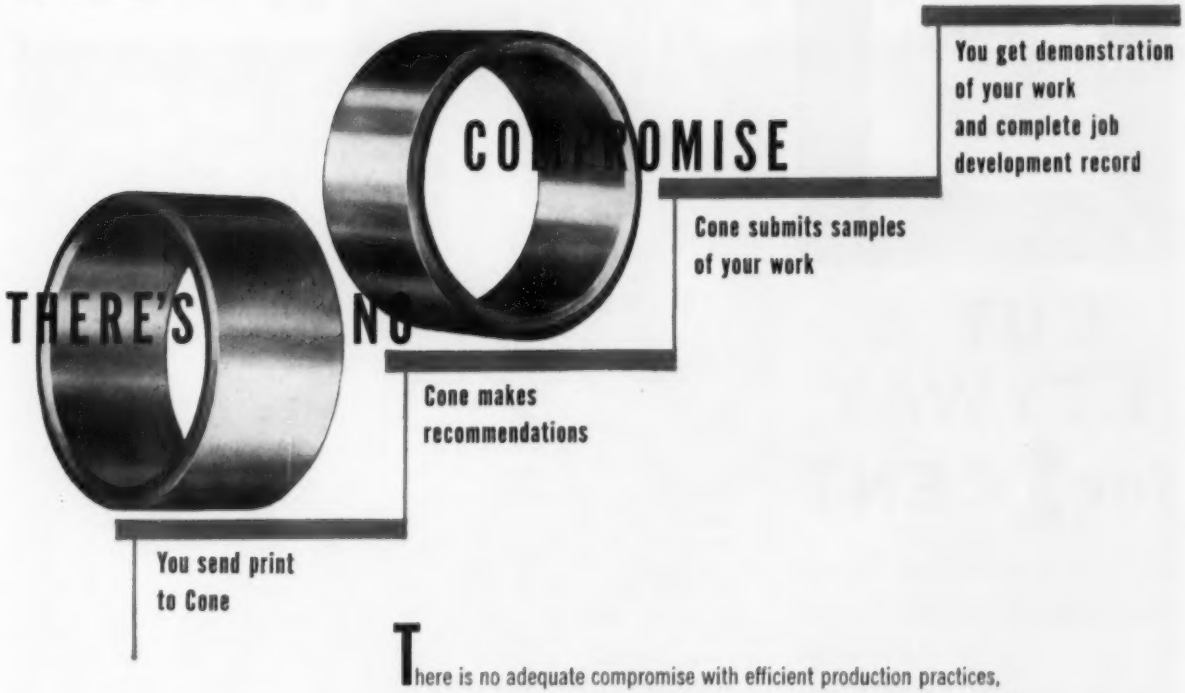
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

No. 6 in a series


THERE'S NO COMPROMISE
You send print to Cone
Cone makes recommendations
Cone submits samples of your work
You get demonstration of your work and complete job development record

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	⅝"
Machine	1⅜" Conomatic	Hole Dia.	1¼"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1⅜"		

Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

CUT A KEYWAY for 1 CENT

Using a Minute Man Keyway Broach Kit, you can cut keyways for as little as a penny a piece in just one minute. For keyways from 1/16" to 1" in any bore from 1/4" to 3".

Minute Man

SQUARE BROACHES

For finishing cast or drilled holes in one pass. In stock for 3/16" to 3/4" squares. Hexagon broaches and Production Type Keyway Broaches also in stock.

GET ALL THE DOPE

The duMONT CORPORATION
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

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Letters...

To American Machinist
330 W 42nd St, N Y 36, N Y

At Long Last 0.000,1

I am pleased to see that the Editor himself, at long last, begins the use (*AM*—Sept 10 '56, p152) of Mr Lew Suverkrop's suggestion (*AM*—May 23 '55, p94) and sample article (*AM*—Sept 12 '55, p121) respecting punctuated decimal figures to save time and avoid errors. In the intervening year I noted in *AM* text or advertisements several decimal errors and numerous long decimal figures that required to be ticked off in order to be clear. All of this bother on the part of your readers would have been avoided had you followed that obviously good suggestion when it was made over a year ago. Yet we here, in Britain, are sometimes given the impression that our American cousins are ever so much quicker at taking to good, new things! No matter. Now that the Editor has started to use punctuated decimals, I trust that he will follow the original suggestion generally, throughout text and advertising. And I hope that other journals will follow the good example you thus set for them.

Incidentally, Mr Suverkrop, as a renowned authority on ultra-precise dividing engines, and others also interested in mechanical work of the highest category, will learn with regret of the passing recently of Mr G W Watts of the firm of Hilger & Watts of London, successors to the firm of E R Watts & Son founded 100 years ago. Mr Watts served the firm for over 60 years, and about 50 years ago was responsible for building the Watts' circular dividing engine. This machine continues in service, recognized as one of the world's outstanding dividing engines of high precision.

Oliver Broadbent
Coventry, England

SHOPMATES

N. Jarvis

IS HE TRYIN' TO FIND OUT THE DATE OR MAKE ONE? HE'S BEEN SPENDIN' HALF HIS TIME GAZIN' AT THAT PIN UP EVER SINCE GUS HUNG IT THERE.
UNTIL NOW HE DIDN'T KNOW WHAT YEAR IT WAS ... OR CARE EITHER.
HE'S GONNA MAKE A NEW RULE ... "NO PIN UP PICTURES" -THEN HE CAN KEEP THAT IN HIS DESK WITH HIS COMIC BOOKS
H. JARVIS

COMPLEX DRILLING PROBLEMS?

Here's how Belock Instrument Corp. solves theirs with modern punched card production control and . . .

LELAND-GIFFORD *Multiple Spindle* DRILLING MACHINES

Belock Instrument Corp. of College Point, N. Y., builds fire control systems, bomb sights, radio frequency tracking equipment and other precision electronic and mechanical equipment. Some of these units have as many as 7000 precision parts.

To keep on top of their complex production drilling operations, Belock employs an IBM punched card system to budget machine time and to schedule related operations for maximum machine utilization.

At the business end of this modern production control system is this battery of Leland-Gifford Multiple Spindle Drilling Machines. Each job goes to the right machine where the right tools are ready for use, in the combination called for, with the right speed instantly set and checked by the Leland-Gifford indicating shift. Centralized controls and built-in safeguards against costly errors also help to speed work flow.

Always preferred for precision drilling, today's Leland-Gifford machines offer you even more in performance, economy and efficiency. New bulletins describe the latest time-saving, cost cutting features. Write for them.

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Drilling Machines
WORCESTER 1, MASSACHUSETTS, U. S. A.

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10429 West McNichols Rd.
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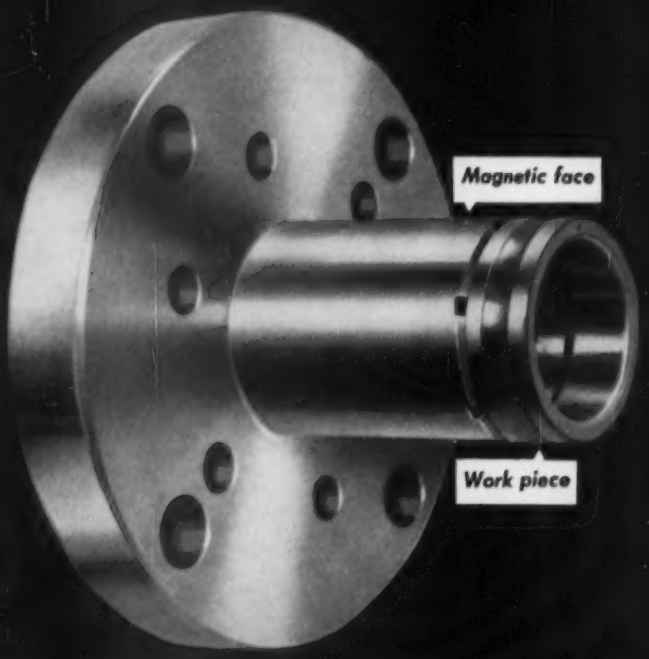
South Orange, N. J.
LOS ANGELES OFFICE
2620 Leonis Blvd.
Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

Walker Does It Again-



Automation Requires:—

Magnetic Drivers (simple mounting). Magnetic holding solves the problem for leading manufacturers of bearings. Again O. S. Walker pioneers with the production of a magnetic driver which adapts itself to bearings for automated operations involving high production.

Whenever any holding device is needed,
Walker engineers design and produce it.

O. S. WALKER CO. Inc.

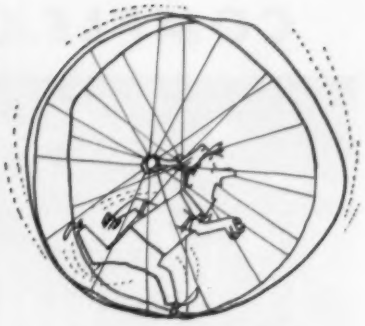
WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

PIONEERING IN MAGNETISM

The longest and broadest experience is yours when you specify a Walker Chuck, for it was nearly seventy years ago that O. S. Walker produced the first successful Magnetic Chuck. Since then, the know-how in magnetic holding devices has been evident in countless applications of rectangular, swiveling, rotary and special type chucks. And, within the last decade, the O. S. Walker Company engineers have perfected Special Vacuum Chucks to harness atmospheric force to all non-magnetic materials. The Walker line also includes, Demagnetizers, Planer Parallels, and all types of Special Magnetic Lifts.

Walker engineers, ready to help you with your holding and lifting problems, are always as near as your telephone, Worcester, Massachusetts—PL 6-6293.



Round and Round

We have read with considerable interest the article, "Round Carbide Tools Show Improvement" (*AM*—Aug 27 '56, p119).

From our experience with such tools and/or the modification thereof, the inference may be drawn that the article is not entirely correct. Quote Lolly Studios formula: "The efficiency of a cutting tool is directly proportional to the sum of all the variables." In the application of this formula there is a point at which the efficiency to achieve a certain effect is at a peak for a certain type and/or complexity of metal. From the above formula it becomes at once clear that he who attempts to transpose cutting tables and tool geometry to his machine and work is not in possession of all his buttons and/or variables. He can, by study and experimentation of such materials, acquire some measure of success. Each variable, it should be distinctly understood, has limiting factors and, when these are better understood, then you are well on the way to a better tool application.

Our round tool applications revealed some of the sharpest, stringiest, and worst chip formations that we have ever encountered. Then again, we have had the tool spout and throw the chips like the shower of a Roman candle. Does a round tool reduce chatter? We have found that it is more subject to chattering than some of the more simple tool geometrics; that is, under like conditions. We also found that the tool is subject to cratering and/or excessive wear on the shearing periphery. We did alter tools to overcome these objectionable features, resulting in a measure of success, depending upon what one is trying to achieve. Chatter is directly proportional to the balance between all the variables and the tool geometry. In one case

we changed the geometry by reducing the effective diameter to less than ⅛ in.

You can design your tool to shear, to slice, and to tear metal from the work. Chatter and a poor cut result when the tool geometry and variables are so balanced that the cutting action hops about between these actions. In the above case we tore metal (tool steel) from the work at more than 200 fpm with a HSS toolbit. The result was a self-sharpening toolbit and a workpiece with a fine velvet finish with a tooth to it. Work diameter was off size 0.004 in. per ft because of tool wear. In another case we designed a tool setup for a slicing cut to achieve a fine finish. The edge of such a tool as we designed does not last long unless it is able to move or revolve with the direction of chip flow to overcome the erosion of the slicing edge.

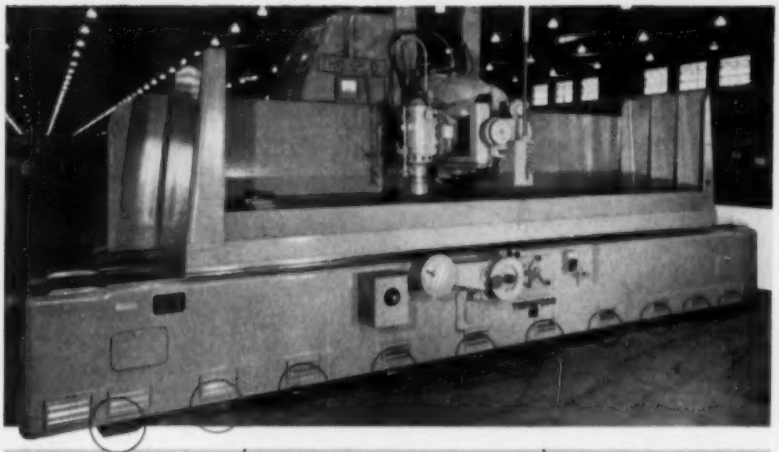
Our experience seems to point out that this last variation of a round toolbit has a future as the geometry for light and medium cuts. As our experience is limited, this should, of course, be taken with a large grain of salt.

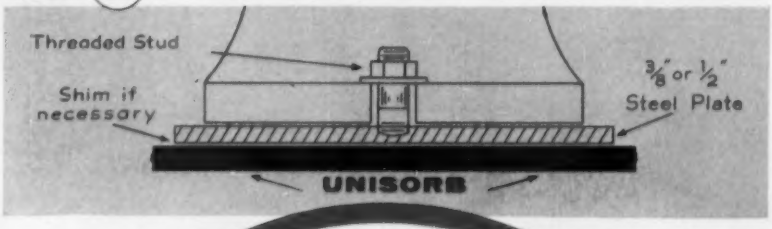
Walter Schmidt
Highland Falls, NY

The American Way

Evidently J LeFevre is a Frenchman himself (*AM*—Sept 24 '56, p97) and has the common French disregard for law. I quite agree that they can't put us all in jail, but that's not the American way of doing things. If we don't like the Income Tax—and who does—there are proper and lawful ways to have the law repealed. If LeFevre really wants to organize a crusade to get rid of an iniquitous, and possibly unconstitutional, tax, I shall be glad to pitch in with him. Let him begin by writing to his Congressman and Senator, urging them to initiate legislation for the repeal of the Income Tax law. Then let him persuade all his friends to do the same. If he has, or can raise the money, let him put on an advertising campaign to get everyone to do the same. That's the proper, American way to do it.

Robert Bentley
Los Angeles





Mount Precision Machines on Type "T" Unisorb . . . for Improved Production

Can you easily install your precision machinery — and be sure it stays level? If they are mounted on Unisorb you can. That's just one reason why production men specify Unisorb to anchor all their precision machinery, from the smallest tool to the biggest giant. It also gives complete flexibility to production lines; and all that's needed is the Unisorb and Unisorb cement — no bolts, lag screws or floor patching.

Get all the facts about this important addition to your production "bag of tricks". A free book shows the four big ways UNISORB has "paid off" for others — and how it can pay off for you. Contact a Felters representative — in all principal cities — or write Felters in Boston.

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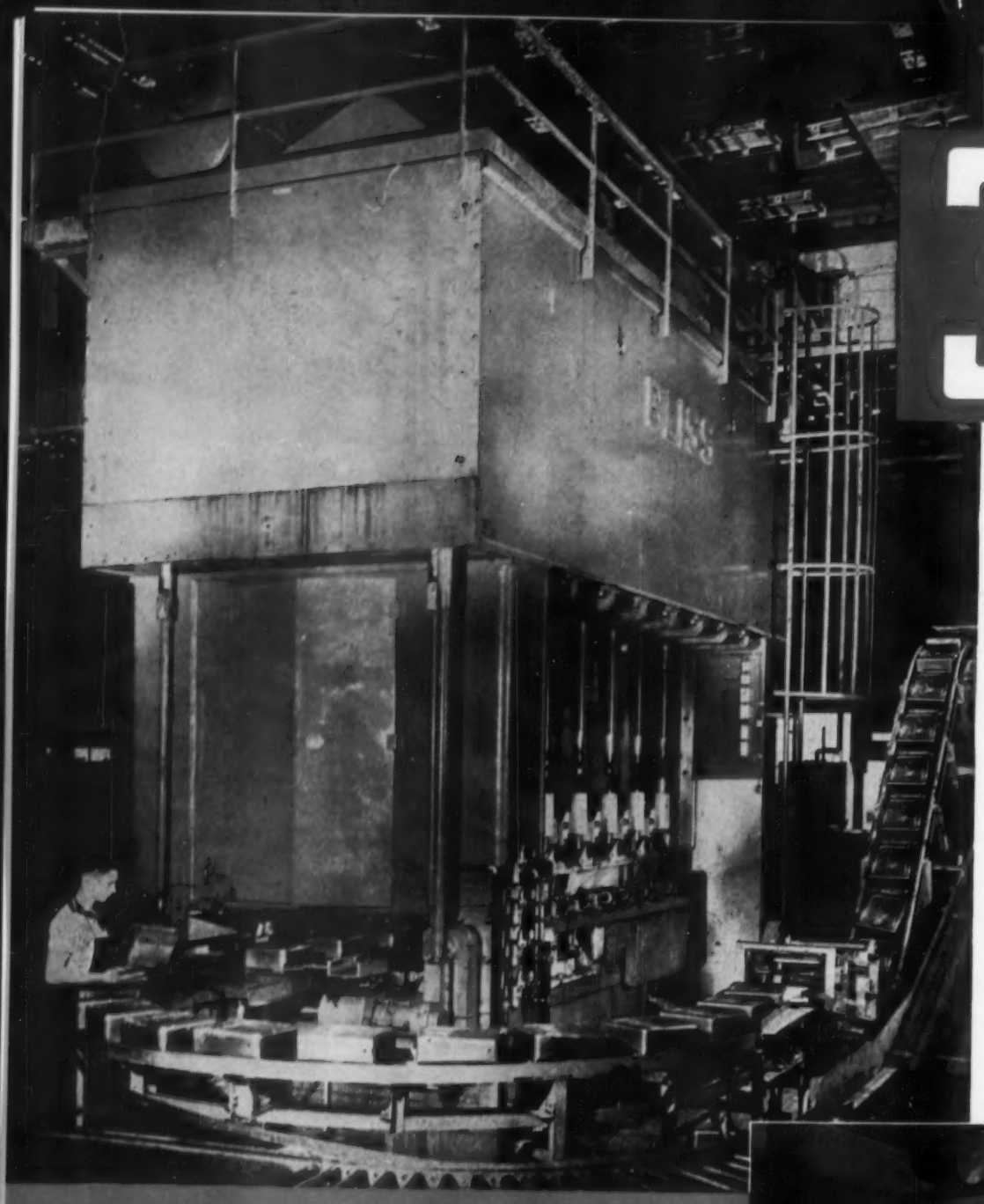
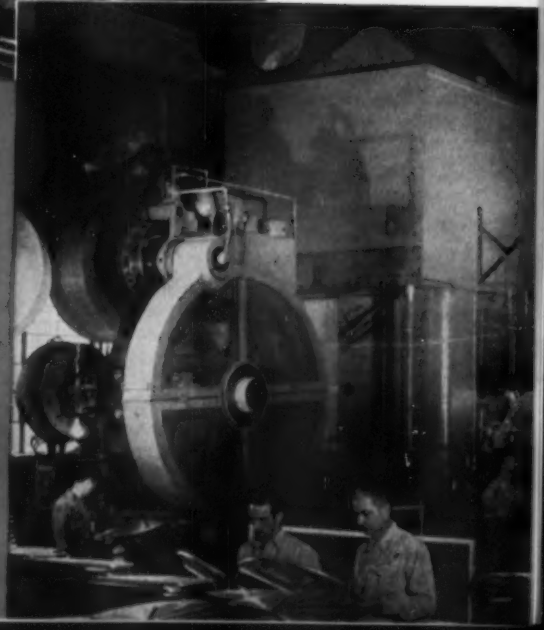


THIS ONE MAKES PANS . . . Pans are produced at the rate of ten a minute in this 700-ton seven-station Bliss transfer feed press. A 22" x 24" blank is drawn 5½" deep in the first station; trimming, piercing and restriking operations follow. Pans leave the press completely finished — ready for pickling and enameling.

THESE TWO MAKE SHELVES . . . "Lazy Suzan" shelves by the millions are the product of these two 800-ton Bliss transfer feed presses and the two Bliss embossing presses stationed at their output ends. Coil stock is blanked in the first stations of the presses and work pieces carry through the remaining five stations and into the embossing press automatically. Each press produces 15 shelves per minute through two shifts.



BLISS TRANSFER FEED PRESSES STEP UP GE REFRIGERATOR PRODUCTION

Between them, they make all the pans and all the shelves GE needs for its annual output of more than half a million refrigerators!

Here's what's happening at Appliance Park: 6000-pound coils of steel feed into one end of these Bliss transfer feed presses, lines of shelves and pans march out the other ends, and only a few attendants stand by in between.

Three separate press lines are involved. One is a 700-ton, seven-station press (with coil cradle, straightener and roll feed) that produces ten deep-drawn pans a minute.

The other two — identical set-ups — are 800-ton, six-station presses, also with cradle, straightener and feed, which feed into 800-ton embossing presses (see photo). Each produces shelves at the rate of 15 per minute.

The method of operation is the same for all. Mill coils are loaded on the cradle. From there, strip feeds through the straightener and into the roll feed. At the first die station in the press a blank is cut off. The transfer feed fingers move in on the work piece and carry it to the next station. As the slide comes down, the fingers move out; as it rises, they move in and repeat the cycle. New strip is brought to the first station and a completed part delivered with every stroke of the press.

This set-up has solved a number of knotty problems for General Electric. Previously production required the services of two or three vendors, doubling and tripling the cost of dies and labor. Still further savings have come from the use of standard mill coils instead of blanks. In fact, the savings are expected to bring about an early amortization of the entire installation.

Bliss has been building transfer feed presses and systems like this since Spanish-American War days; today, over a thousand are in use. If you're faced with long-run production problems, let a Bliss engineer show you some typical uses of the transfer feed principle. Perhaps it can pull your production costs into line — as it has for so many others.

SEE IT IN ACTION . . . *A new color-and-sound movie takes viewers to the plant, shows the press in action. See close-ups of tooling, of transfer fingers, of coil feed techniques. To arrange a showing at your plant, write to E. W. Bliss Company, Canton, Ohio, or see your local Bliss representative.*

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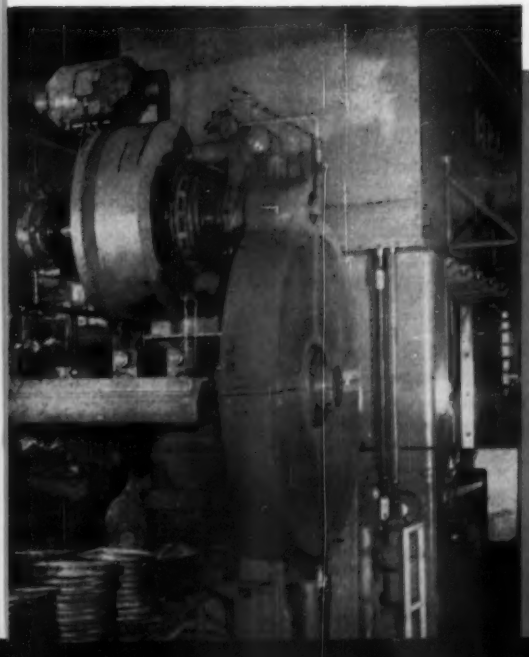
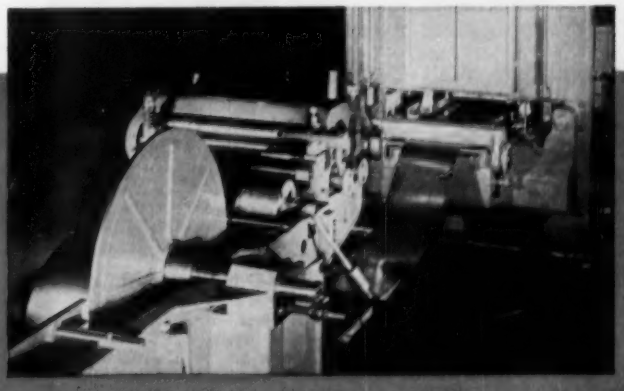
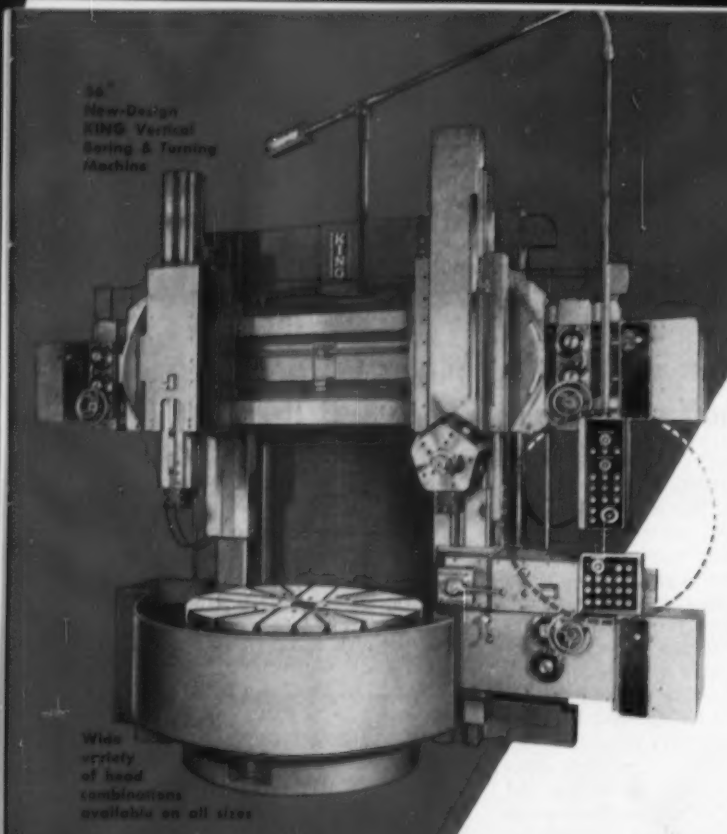




ALL THREE LINES WORK FROM COIL STOCK . . . A number of handling operations are eliminated because, on each of the three presses, strip from standard-sized mill coils are fed from this power coil cradle through a five-roll straightener and into the roll feed on the press. Blank is cut off in the first die station of the press. Though not shown here, a second coil is ordinarily held ready at the rear of the cradle to speed handling. Bliss engineers designed all the coil handling equipment and all of the tooling for each of the presses.

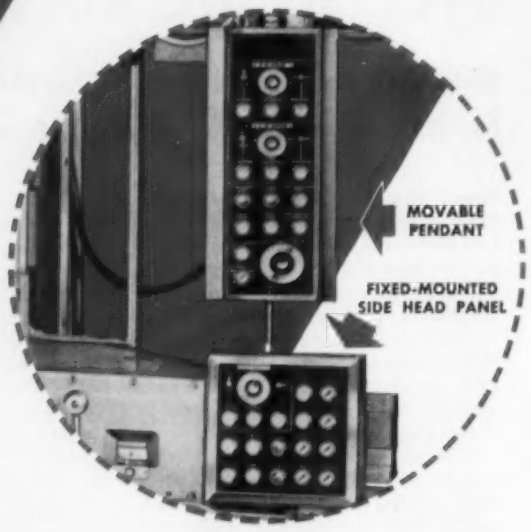


56" New-Design KING Vertical Boring & Turning Machine

Wide variety of head combinations available on all sizes

New-Design

KING



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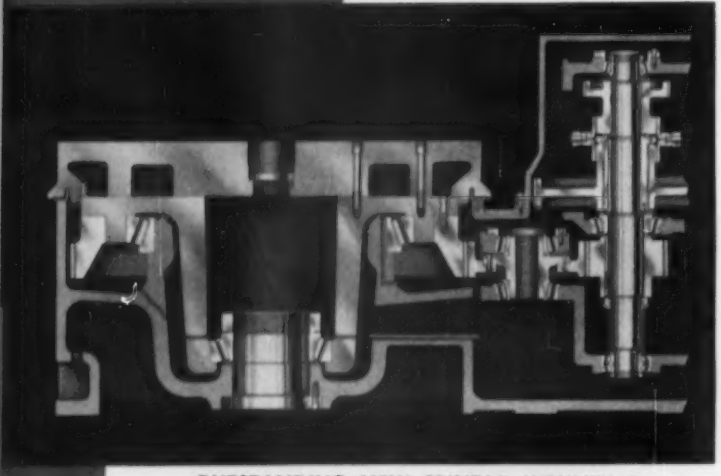
. . . gives you faster production at lower costs!



OUTSTANDING NEW SPINDLE MOUNTING

As shown in drawing, the spindle itself is extra heavy and rigid. Tapered roller, pre-loaded bearings are located so as to provide maximum spread, both radially and vertically, on the spindle. This construction greatly increases stability of the mounting. Note also that the drive is of helical-gear type, eliminating any tendency toward spindle deflection and loss of accuracy—a tendency always present with bevel gearing.

Full electrical operation has been engineered into these streamlined New-Design KING® Vertical Boring & Turning Machines. Control manipulation is cut to a bare minimum, speeding set-up time. Direction of all head movements is established by simplified "up-down" and "in-out" switches. Spindle speeds and feeds for all heads are pre-selective from direct-reading dials, conveniently located on the movable pendant and fixed side head panel, as are all other electrically operated controls.

Increased horsepower plus expanded speeds and feeds will remove metal at rates that take fullest advantage of the most modern cutting tools. Improved spindle operation, with resultant increased accuracy, is assured by many advanced construction features as illustrated in drawing at left. Integral drive construction permits removal of the entire drive as a unit, for easy maintenance.

These and other superior advantages in the new KING machines will greatly increase both accuracy and productivity on your boring, facing, and turning work. For full details see your King Distributor, or write us direct.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

Spot news...

- **You'll see a "Super Mercury" in 1958** in addition to the regular Mercury line. The car is so big and so luxurious that a program is now under way to separate dual Lincoln-Mercury dealerships. Lincoln dealers will undoubtedly get the new "Edsel" line as a replacement.
- **Egypt is worried that it won't be able to get Western steel** as a result of the Suez crisis. The Egyptian Suez Canal Authority because of this is already dickering with the Japanese for steel plate and shapes, chains and ring...
- **Walter Reuther will ask for a four-day, 32-hr week for autoworkers in 1958.** He also claims that industry and labor wouldn't have to battle over this at all if the government would amend the present 40-hr-week Wage-Hour Act to 32 hrs, and cut federal employees' work hours accordingly.
- **A typographical error recently caused a strike,** or so management of Kennedy Automatic Products Inc, Marshall, Mich, says—claiming a nodding proofreader let a 4¢-an-hour cost-of-living boost slip into the contract's printed text, when actually none is due at this time. Management is reneging, said the union, promptly struck the plant.
- **To prove the feasibility of cathodic protection,** Dow Chemical equipped an 18,000-ton vessel with 180 magnesium-alloy anodes on the hull under the water line a year ago. Ship was put in drydock recently, inspected. The findings: hull damage from salt water was cut sharply.
- **Warehouse operators are making plans to stock titanium** just as soon as prices come down and fabricators find wider uses for the metal.
- **Air Force says at least 70% of its inventory of about 92,000 machine tools** and 50,000 other production equipment items is in active use. Based on acquisition costs of about $1.3 billion, machine tools make up nearly $980 million of the total.
- **England's Liberal Party has come out for automation.** At a party meeting, a speaker said "I look forward to the day when there is a strike because a works has not introduced automation," was roundly cheered by delegates.
- **A 75-ton baling press that can compress an auto body into 14 x 20 x 36 in.** has been installed at Mason Iron & Metal Co, Detroit. Built by Chattanooga Welding & Machine Co, it is said to be the world's largest.
- **Resistance-welding control device developed in Germany** controls the weld cycle of spot welders, or the speed of advance of a seam welder by reference to temperature instead of time.
- **A new system of linear position control for precision machine tools,** developed by a Canadian firm, is said to measure linear displacements to accuracies of 0.0001 in. over several feet.
- **40% of all single-point tools** will soon be throwaway ones, according to an independent survey made for Wesson Co, carbide toolmakers. Present figure is 15%.

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MAXIMUM PRODUCTION SPEEDS — LOWER COSTS WITH THESE MODERN

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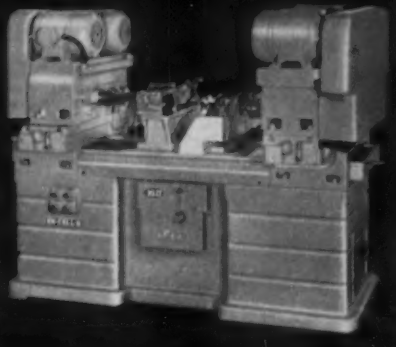
STYLE 1212-B. For identical or different operations at each end. When loading time of parts approximates the time of machining, a double-end machine practically doubles production.

STYLE 2112-B. Single-end model for work pieces in the small and medium-size range. Flexible hydraulic controls give easy adjustment of work cycle.

STYLE 112-D. Large and sturdy with long stroke. Accommodates medium and heavy work, gives maximum precision production, minimum operating cost.



STYLE 17-A. Massive construction. Maintains the highest precision standards on a profitable production basis. Economical in operation, can be tooled for a wide range of production jobs.

These versatile Ex-Cell-O Precision Boring Machines bore, turn, face, counterbore, chamfer and groove.

Whichever model fits your production requirements, you'll find this large variety of precision operations will lower your costs—increase your profits.

All Standard Ex-Cell-O Precision Boring Machines can be equipped for work handling and ejecting operations, thus providing fast, automatic production at minimum cost.

Contact your local Ex-Cell-O representative who will provide all the facts about these machines, or write to Ex-Cell-O for a precision boring catalog.

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Washington ... NEWS REPORT

More loans for small business . . .

Look for a big step-up in government loans to small business. This is what's behind it: President Eisenhower's closest economic advisors argue that tight money may well last as long as the boom in capital spending is under way—maybe for years—and that the credit stringency falls harder on small firms than on any other segment of the economy. Small business has the strength to stir up an issue over tight money, the argument goes, so something is needed to ease the pinch.

The outlet will be the Small Business Administration, whose lending program is being speeded up. Already, SBA has granted $69 million worth of loans in the first seven months of this year, out of $173 million worth of applications. For the same period last year, only $32 million was lent out of $104 million worth of applications. In all, there's been a rise in the percentage of loans granted—from 39% last year to 58%. Now the agency has started to merchandise its lending program even more, is playing up its fund of $50 million still available for small firms.

Some critics inside the administration—notably Treasury Dept and Federal Reserve officials—dispute the claim that small business is being especially hurt by tight money policies. They also ask how Washington can keep tight money on one hand while ladling out loans on the other. Ike's advisers answer that funds involved in small business aid are peanuts—only in the millions—compared to the general economy. The critics also pour cold water on a White House proposal that businessmen who are unable to get credit at commercial banks are entitled to apply directly to Federal Reserve district banks.

Thumbs down on added writeoffs . . .

Office of Defense Mobilization has officially said "No!" to the steel industry's applications for fast amortization on about $1.4 billion worth of plant expansion. Over a dozen leading steel makers are involved.

The administration still refuses to help new expansion unless and until it can be fully rationalized in terms of defense needs.

But, formally, the door is still open. ODM said its decision will stand until the Defense Dept comes up with a new review of long-range hard goods requirements. This is due in a couple of months. By postponing the decision, in effect, the administration may be getting itself off a tricky election-year political hook. If the government had granted the new writeoffs, Democratic charges of favoritism to big business would have followed. If it had flatly turned down the requests without holding out some hope for next year, both producers and consumers of steel would have yelled louder than they are now.

Government competes for engineers . . .

You may have to compete with the government, dollar for dollar, for engineers next year. Legislation is being drafted by the Budget Bureau—with White House support—which would enable federal agencies to pay competitive rates to get the engineers they need.

In many areas, Civil Service pay levels lag behind industry pay for engineering manpower. Among the agencies involved: The Army's Corps of Engineers, the Bureau of Public Roads, the Bureau of Standards, and others hard up for hard-to-hire technicians.

Court labor-docket heavy . . .

A host of labor disputes are up for decision in the U S Supreme Court. Dozens of labor cases have already been set for argument, others will be taken up by the Court later on. Here are some key cases the court has just agreed to decide:

- **Whether a strike called by a union** against one member of an employers' association—after an impasse in bargaining with the association had been reached—legalizes a lockout of employees by the other members of the association.
- **Whether federal courts have jurisdiction** under the Taft-Hartley law to compel employers to comply with an arbitration clause in collective bargaining contracts.
- **Whether a company violates Taft-Hartley** by changing its seniority policy after an unsuccessful strike, to give preference to non-strikers and to employees who had returned to work during the strike.

Other labor issues to be decided early in the Court's term are (1) Can states handle a labor dispute affecting interstate commerce and involving alleged violations of the federal Taft act, when the NLRB would refuse to take the case because it does not meet NLRB's jurisdictional yardsticks? (2) Can a union strike during a long-term contract at the time of a wage reopener if it gives the 60 days' notice required by the Taft act? and (3) Is a Union guilty of unlawful refusal to bargain if its members engage in harrassing tactics during contract negotiations—such as unauthorized extensions of rest periods, refusals to work overtime, etc?

"Like many other firms," says Mr. A. Balas, Equipment Engineer at Mergenthaler Linotype Co., N.Y.C., "we are constantly on the alert for new equipment, new processes and new ideas. This constant search for improvement convinced us of the need to purchase a versatile, time-saving, cost-saving and, above all, accurate Horizontal Boring Machine. We checked them all — feature for feature — and then bought the Bullard H.B.M., Model 75. We feel it has enough "built in reserves" to take care of any contingency or new development which may come up. It's reassuring to know that an investment of this size won't go out of style next month."

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THE BULLARD COMPANY BRIDGEPORT 9, CONN.

Detroit ... NEWS REPORT

The crystal ball for '57 . . .

Along about this time of year, automakers take a long, long look at their competitor's products, and an equally long look at their own. Then they check their economists on the pulse of the nation, take a deep breath, and plunge headlong into the dark pool of an auto output forecast:

The economists themselves are going in for muted optimism. They point out that 1956 wasn't such a bad year after all—that it has run just behind 1950, the industry's second best year.

For the '57 model year, they predict 6.5-million cars and 1-million trucks will be produced. Even more optimistic, generally, are the vice presidents and managers who head up individual car divisions.

Over at Chevrolet, they're inclined to go along with the 6.5-million estimate, and figure to corner about 28.1% of that figure.

Buick people are much more optimistic, expecting Buick sales to run 25% or so above the 1956 mark for a production total of 675,000 cars. Buick slipped from a 10.3% slice of the market in 1955 to 9.5% in '56, but is back on its target of beating out Plymouth.

Quiet confidence prevails at Cadillac, which produced and sold nearly as many cars in 1956 as it did in record 1955. This year Cadillac expects to outsell its nearest competitor 3 to 1 and to retain a solid 2.4% of the total market. The Cadillac people figure the all-industry figure for the '57s will run to 6.67-million cars.

Pontiac is openly shooting at Chevrolet's higher-priced line, the BelAire. Pontiac's new general manager Semon E Knudson predicts a 6.5-million output, figures to take 8% of it. That adds up to 525,000 cars. Pontiac's best previous share of the market was 7.67% in 1941. In 1956, Pontiac accounted for about 6%.

Chrysler traditionally shies away from quoting figures, but it's pinning its hopes on Plymouth capturing a solid 10% or more of the '57 market.

This is the year Chrysler as a whole has to make a splash with all divisions, but Plymouth will carry the ball. Chrysler Corp slipped from a 1955 mark of 17.15% down to 14.3% in '56.

At Ford, division heads hope for an optimistic 6.5-million industry output in 1957. Ford division is relying on a completely restyled car and an early introduction date to get a flying start in its annual race with Chevrolet.

At Mercury division the air is charged with hope: they're aiming at a 6.5% market penetration for a 100,000-unit increase over 1956. Prime Mercury targets are Buick and Olds.

Lincoln Division, quiet and restrained, is slating a 26-40% increase over its 1956 output.

Among the independents, frustration is masked with a belligerent air. AMC, with a tough road to travel, has slashed tooling and output with a reckless hand. It's no secret that AMC has spent little on its '57s, and will probably spend even less in '58. Nash and Hudson will be de-emphasized. And for the first time, production figures on the Rambler are public property—they show it will get AMC's overwhelming attention.

Studebaker-Packard plans are still hazy. The '57 Studes look good, and there's talk around Detroit of major tooling changes for the '57 Hawk line. Latest word is that a major body shell change for the 1958 Hawks is upcoming: door openings that extend well into the roof line; fins that swoop outward so far they have a rubber strip inset in the top for rub protection; an absence of chrome; and a strong possibility of fuel injection on all Hawk models.

Summed up: by all accounts and forecasts, 1957 will be a good year for the auto industry (6.5-million units is the consensus), with unusually strong emphasis on sales.

Tooling and output addenda . . .

Watch for a swing from leaf to coil springs this year. Idea of the switch is to spread tooling expenditures over a 2-3 year period while the industry is changing over to air suspension. A change from leaf-spring to air suspension in one jump would be prohibitively expensive: a change from leaf to coil to air less so.

Cadillac's super-luxurious Brougham (reported price tag $12,500) won't go into production until late in November, and with a 2-3 month lag won't hit the showrooms until well into the winter. Total production of the Brougham won't exceed 1500 a year, but it's 500 more than the Continental Mark II, its chief rival, will turn out in 1957.

Latest word out of Chrysler is that Chrysler Corp President L L Colbert is predicting annual output of 8-million cars by 1965.

DeSoto, after introducing Goodyear's new "captive air" tire on its station wagons, plans to put the tire into its regular models later on in the '57 model year. This would eliminate the spare wheel and tire altogether.

STEP UP Metal-Sawing Production in ALL of 7 ways:

• *The New No. 2-8 Automatic Motch & Merryweather Circular Sawing Machine.*

1. LESS TIME
2. LOWER TOOL COST
3. MILLED FINISH
4. BURRLESS ENDS
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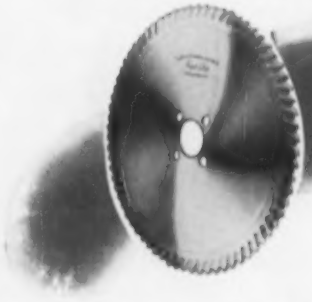
THE MOTCH & MERRYWEATHER *Triple-Chip* METHOD DOES JUST THAT!

CAN YOU EQUAL THIS { TIME / COST } BY ANY OTHER METHOD?



Material — 3" dia. SAE 1020
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Machine tools ... NEWS REPORT

Ford's tooling buildup . . .

Ford will not be content with its competitive position in the automotive field until it has challenged General Motors at all price levels.

It accordingly is reported to have orders in machine tool builders' hands for the tooling necessary for two new engines.

These engines are destined, according to reliable reports, to go into two new cars, one in the Buick and the other in the Pontiac class.

The new cars are scheduled for introduction at the beginning of the 1958 model season a year from now. Most of the machine tool orders for the two engines were placed some time ago.

A considerable part of the special machines, including huge transfer-type units for production of 1957 car models, has not yet reached plants of automobile companies.

Some of the machines have been delayed by an excessive number of engineering changes. One machine builder privately reports that more than 200 changes affecting its own orders were made by an automobile customer on one job. Total engineering changes on the job have topped the 1100 mark.

Certain mammoth transfer-type units for use on 1957 model production will not be installed in automotive plants until December or January.

This does not mean that manufacture of cars will be delayed, but merely that the overall program of tooling will not be completed until the year-end or later.

Big orders from overseas . . .

Special machinery builders, almost all of whom have at least a full year's business in hand, are now processing and in many cases have about completed, big units for GM's Vauxhall Division and Ford's Dagenham plant in England.

Both General Motors and Ford have spent large sums with U S builders for transfer-type units, as well as for other special machines.

European automotive expansion and cost-cutting programs, in fact, have been the source of a lot of U S machine tool business this year.

Orders have come from General Motors' Opel Division in West Germany, from Volkswagen at Wolfsburg, from Daimler-Benz at Stuttgart, from Simca and other auto companies at Paris, and from Fiat at Turin, Italy.

Fiat recently secured a sizable loan from the Export-Import Bank to buy U S tooling.

It is a safe bet that the Fiat plant contains more U S machine tools than any other plant in Western Europe.

The British have imported more machine tools from the United States this year than from Germany or any other country.

U S machine tools delivered to customers in the United Kingdom in 1955 added up to $18.4 million. Germany supplied $14 million.

Transmission delay at Buick . . .

Buick, which found it necessary to postpone completion of its new transmission tooling program because of important engineering changes, has agreed to accept delivery of machines to be completed after the suspension date. The bulk of the machines had been built and delivered to Buick prior to the holdup.

Financial woes . . .

Machine tool builders, with bulging order books, are finding that their expanded operations are making it tough for them financially. They must finance much larger inventories, parts and components purchases, and payrolls.

In view of the fact that many big special machines run from $200,000 to $500,000 in price, and even up to $1 million in a few cases, more financing is necessary than formerly.

Some builders have been able to secure so-called progress payments for units of extraordinary size. But this is the exception.

One large builder requiring more working capital to meet increased volume and higher basic costs, has resorted not only to issuing some preferred stock but also to bank loans of $10 million. Another builder borrowed around $1 million on a short-term basis.

Orders exceed shipments . . .

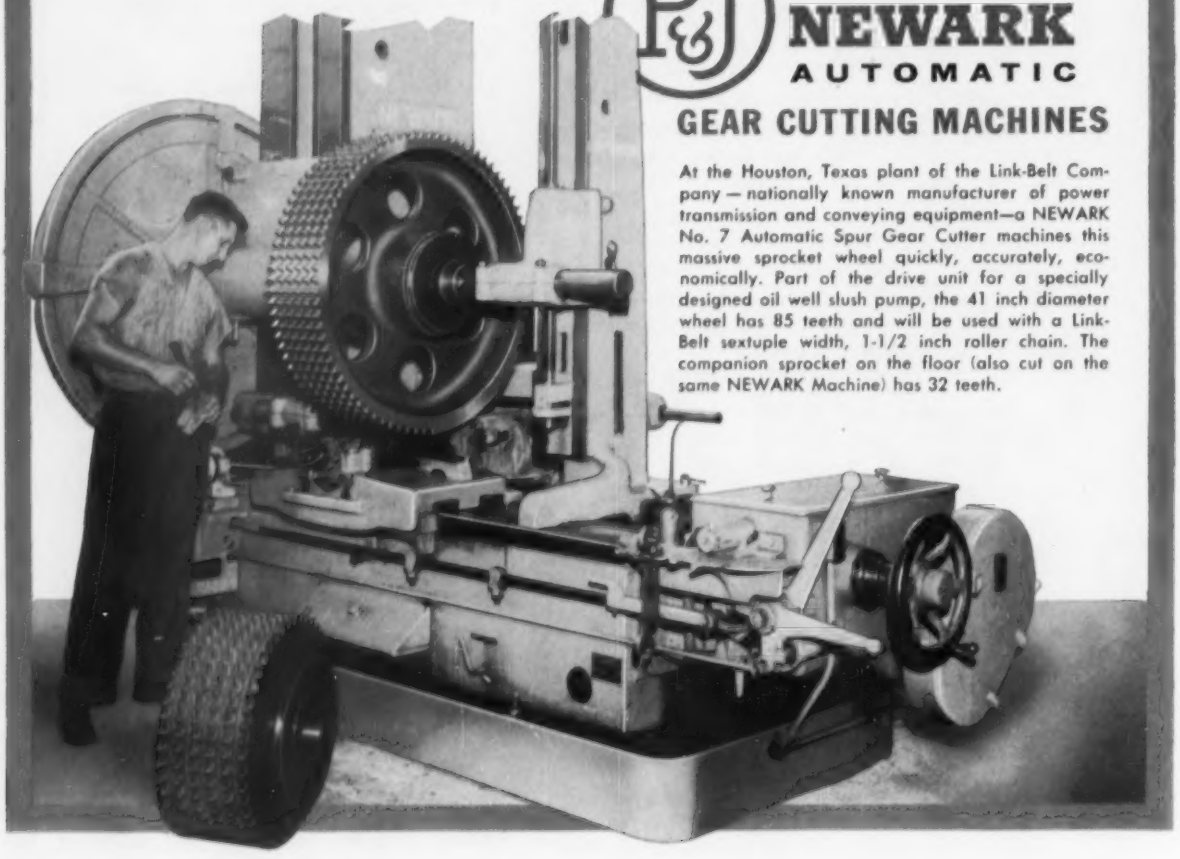
For the second year in succession, net orders for machine tools will surpass shipments.

In 1956 orders are almost sure to go higher than $900 million. Shipments will not be above that figure, if that high. In 1955, orders totaled $927 million, and shipments $670 million.

Next year looks like a big year for the machine tool industry. Both new orders and shipments should be at least $1 billion.

Specialists who KNOW rely on

P&J NEWARK AUTOMATIC GEAR CUTTING MACHINES



At the Houston, Texas plant of the Link-Belt Company — nationally known manufacturer of power transmission and conveying equipment—a NEWARK No. 7 Automatic Spur Gear Cutter machines this massive sprocket wheel quickly, accurately, economically. Part of the drive unit for a specially designed oil well slush pump, the 41 inch diameter wheel has 85 teeth and will be used with a Link-Belt sextuple width, 1-1/2 inch roller chain. The companion sprocket on the floor (also cut on the same NEWARK Machine) has 32 teeth.

When selecting a gear cutting machine, specialists who demand the ultimate in fast, accurate, economical production, look for important features like these: fully automatic operation; quick, simple machine setup; extra strength, power and rigidity; and an indexing mechanism *guaranteed* for accuracy. That's the reason specialists, like Link-Belt, who *know* the difference, depend on P&J-Newark Automatic Gear Cutting Machines for their big, tough jobs.

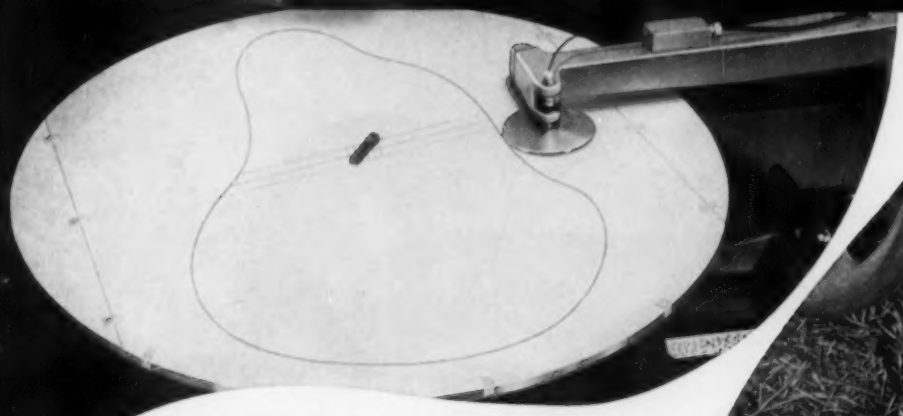
SEND NOW FOR COMPLETE INFORMATION . . . see how a P&J-Newark Gear Cutter can bring new efficiency to *your* spur gear production. Several models handle a very wide range of work size requirements. Write for Bulletin No. 157 or call the Pratt & Whitney Branch Office near you and ask a Direct-Factory Representative to call and discuss your requirements.

Potter & Johnston Company, Pawtucket, Rhode Island (Subsidiary of Pratt & Whitney Company, Inc.)

P&J **POTTER & JOHNSTON**

Precision Production Tooling for More Than Fifty Years

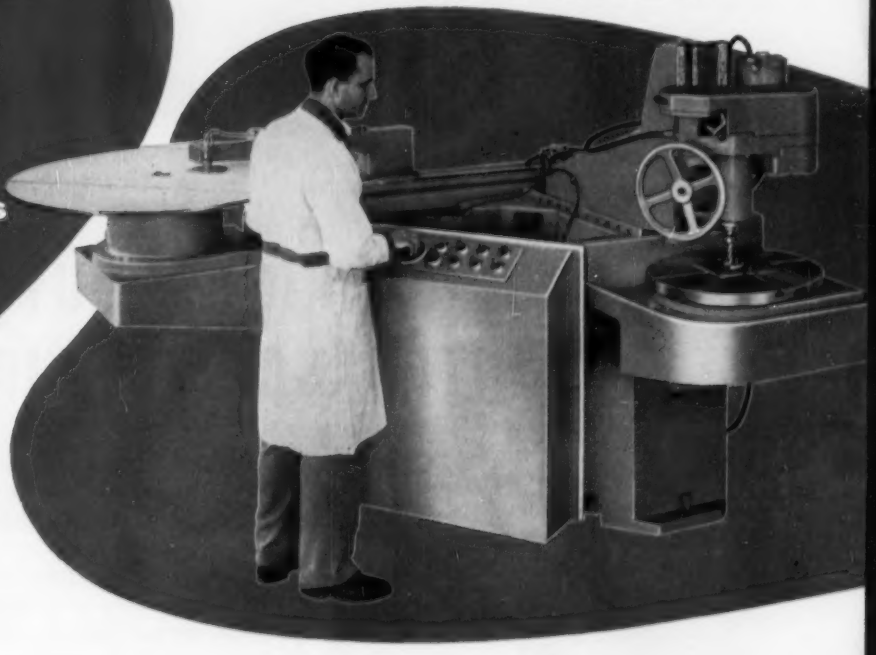
AUTOMATIC CHUCKING TURRET LATHES • NEWARK GEAR CUTTING MACHINES



Here, the non-contacting tracer follows the large-scale contour drawing easily prepared with electrically conductive "ink." For this job, a 10:1 drawing-to-workpiece reduction ratio is used, but any desired scale such as 20:1 or higher can be selected.

Following the action of the tracer, the cutter reproduces the exact shape of the drawing on the workpiece. Due to the selected reduction ratio, any errors in the drawing are reduced in the same proportion; resulting in accurate milling or grinding.

mill or grind IRREGULAR CONTOURS *without* expensive models *or* complex special tooling



- mill or grind directly from simple line drawings
- extremely accurate
- unique, non-contacting tracer control

MODEL 104 *Electronic* CAM and TEMPLATE MACHINE

If you are producing external or internal cams, templates, blanking punches or dies of complex, irregular shape, here are important opportunities for greater accuracy, shorter production times and lower costs than ever before possible! Send for your copy of Circular No. 579-1 fully describing the Model 104 Cam and Template Machine. Or, write to West Hartford on your Company letterhead outlining your requirements. Manufactured by the New England Machine & Tool Company. Sales representation by Pratt & Whitney.

Manufactured by the New England Machine & Tool Company. Complete sales engineering and maintenance service through Pratt & Whitney

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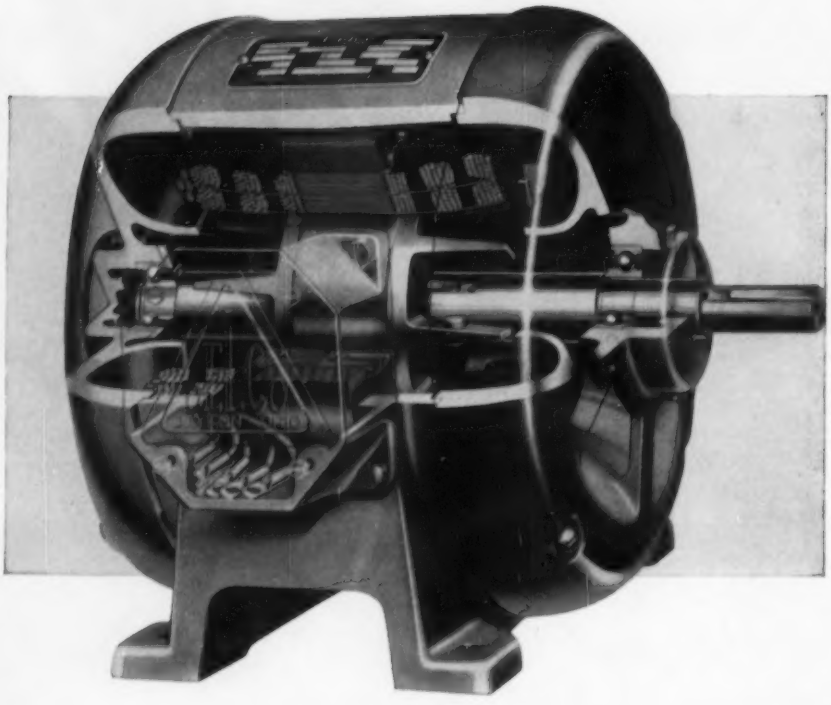
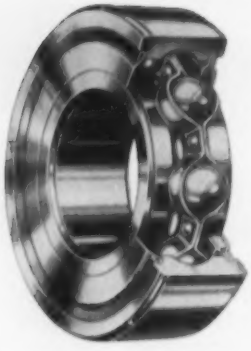
MACHINE TOOLS • GAGES • CUTTING TOOLS

FACTS about **NEW DEPARTURE BALL BEARINGS**



BALL BEARINGS CUT LUBRICATION MAINTENANCE TO VIRTUALLY ZERO



Precision-made New Departure ball bearings assure permanently accurate support of the rotor shaft under all load conditions and mounting positions, plus cool-running, quiet bearings at all speeds.

In normal operation, New Departure sealed and shielded bearings reduce lubricating requirements to virtually zero. Built-in seals on the inside faces prevent grease leakage *into* the motor. Metal shields at the outer faces keep foreign matter *out* of the bearings while permitting entry of just the right amount of grease from the end bell for perfect bearing operation. Overheating from excessive lubrication can't occur.

Join the leaders who look to New Departure for bearings and engineering service in product development and improvement. New Departure, Division of General Motors, Bristol, Connecticut.

BALL BEARINGS MAKE GOOD PRODUCTS BETTER

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NEW DEPARTURE
BALL BEARINGS

GM GENERAL MOTORS

NOTHING ROLLS LIKE A BALL

What's ahead ... in Metalworking

NEWS REPORT

No election jitters for Metalworking ...

The Presidential election campaign is having no perceptible effect upon metalworking production, which is running along at the top pace for the year.

If there is any fear that the results of the election might have an adverse effect upon metalworking activities, it is not reflected in the placing of orders for all kinds of metal goods and for capital equipment. In fact, the fourth quarter promises to be the best three months of the year.

And chances are that the present production momentum will carry over well into 1957.

The steel outlook ...

Auto manufacturers are just a little bit worried about the possibility of a pinch in the supply of cold-rolled sheet. With auto output in the fourth quarter of this year slated to make up for a not-so-good 1956, a shortage could mean an automotive production cutback at a crucial time.

Although the car makers haven't taken their full allocations of steel since last spring, they plan to go all-out on orders for fourth quarter production. That's why the mills fear that tonnage lost during the strike might result in failure to supply all the industry needs. Cold-rolled sheet, incidentally, accounts for almost half the weight of a passenger car.

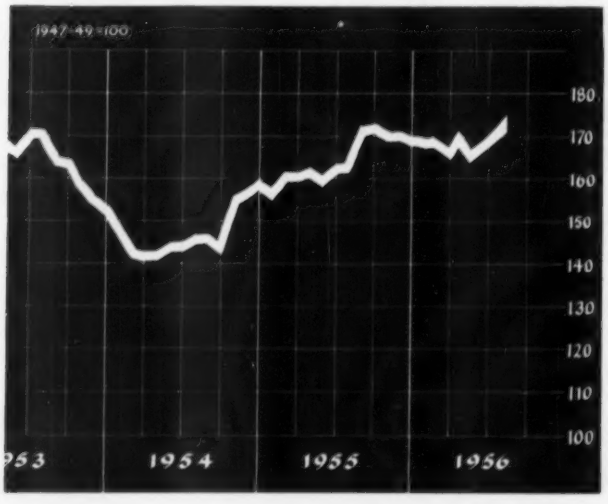
Steel mills are paying a record price for scrap. Out on the West Coast, mills are laying out $55 a gross ton for heavy melting. That's $5 more than in early September, $9 more than in August, and $23 more than a year ago. There just doesn't seem to be any end to the upward spiral—much of which is caused by the high prices Japan and other countries are willing to pay for U S scrap. And the speculators are getting into the act, too.

For the first time in many years, warehouses are the steel mills' biggest customers. The warehousers, who anticipate a banner year, report inventory is generally satisfactory, except for pipe, plate and structurals, and large diameter forging stock supply is tightening up. Average inventory of sheet and strip is adequate, but most warehouses are having their inventory of those items whittled down by strong demand.

Where are the auto orders?

Automotive parts makers say that orders just aren't coming through from Detroit in anticipated and hoped-for volume. One of the biggest parts makers expected October release orders from Detroit to run at least 20% ahead of September: the actual increase—2%. And from here, November doesn't look like it will run much ahead of October, even though the auto industry is predicting a record-breaking fourth quarter.

Tooling problems at the big automakers are to blame, evidently, because of bumper-to-bumper model changeovers. The result is that the parts makers' predictions are running to less than 6-million cars for 1957, contrasted with the 6.5-million-and-more units predicted by the automotive industry itself. (See Detroit page).



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total Index	**175**	**174**	**170**	**170**
Machinery	**158**	**153**		**139**
Electrical Machinery	**211**	**209**		**205**
Autos	**101**	**107**		**139**
Other Transportation	**357**	**335**		**315**
Other Metalworking	**141**	**138**		**141**

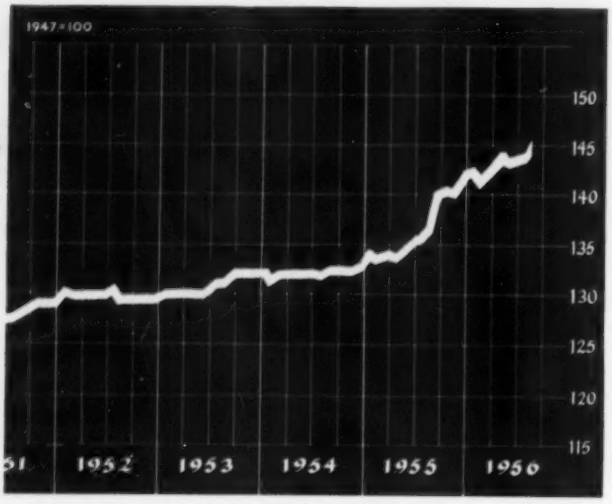
NEWS REPORT

What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	SEPT. Esti-mated	AUG. Pre-liminary	JULY Re-vised	AUG. Year Ago
Total Index	**146.0**	**145.4**	**144.6**	**137.1**
Metalworking Machinery	**167.6**	**165.8**		**156.7**
Other Machinery exc. Electrical	**153.1**	**152.6**		**142.6**
Electrical Machinery	**143.8**	**143.0**		**132.9**
Fabricated Metal Products	**138.5**	**137.6**		**132.4**

146.0



Formula for continuing prosperity . . .

"As goes capital investment, so goes prosperity" is an economic byword. By that yardstick, and by any other yardstick for that matter, we are in for what economists term a "preposterous boom."

Business's plans for investment in new plant and equipment are unprecedentedly high for this year and will be for several years to come. They would be even higher if money weren't so tight. But that's not the only prop to the economy.

Another is the tremendous growth of industrial research and development. This means that in the next few years you'll see new products, new processes and new equipment in quantities the like of which has never before been seen. Some $5.5 billion was spent on R & D this year alone, and by 1959 the annual total will reach $6.3 billion. Add that to the intense competition that new products and processes create, and you have the formula for continuing prosperity.

And don't forget consumer spending as an economic prop. In spite of the involuntary unemployment that has affected workers' pocketbooks in the automotive and farm implement industries this year. And in spite of voluntary unemployment such as that of the steel strike, consumer spending has gone up steadily.

Now that wage increases are almost as regular as the changing seasons in most industries, consumer spending rises proportionately.

And add one more factor to the formula for continuing prosperity: the zeal with which advertising and selling are putting across the nation's goods and services to the buying public.

WEEKLY BUSINESS INDICATORS

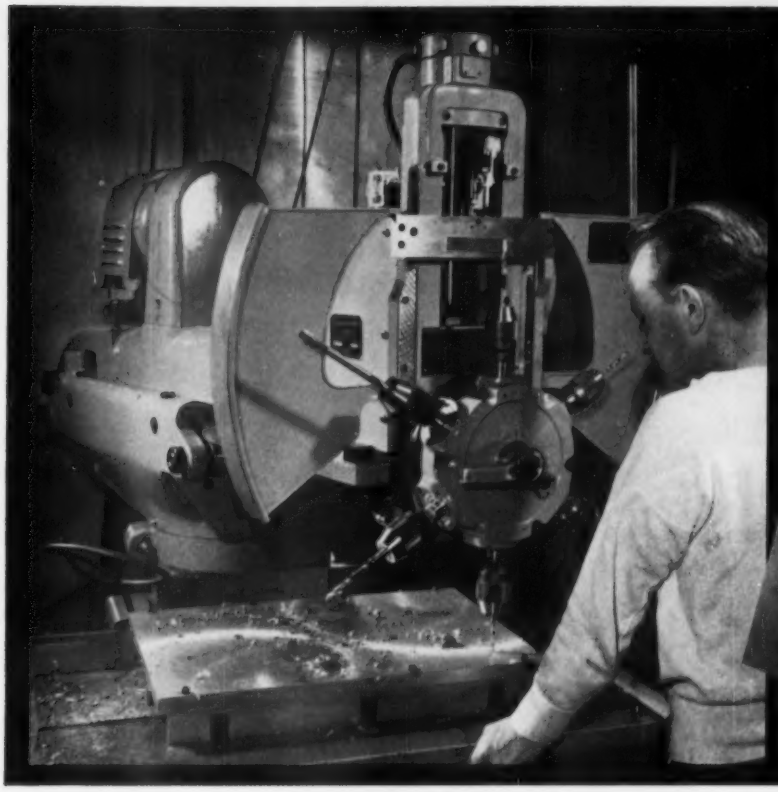
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	147.7	147.7	140.0
Steel ingot production (thousand tons)	2,511	2,506	2,330
Electric power output (million Kilowatt hours)	11,342	11,365	10,639
Production of automobiles and trucks	81,774	29,092	102,196
Engineering construction awards (Eng. News-Record, millions)	$390.2	$491.0	$345.8

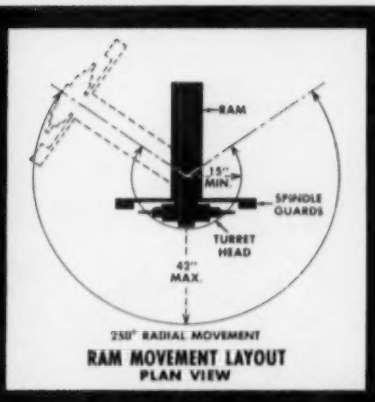
MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	298	332	311
Vacuum cleaners sales (thousands of units)	277	260	256
Washers sales (thousands of units)	374	379	404
Household electric ranges sales (thousands of units)	85	80	87
Radio production (thousands of units)	N.A.	567	948
Television production (thousands of units)	N.A.	337	648
Gear sales index (1947-49=100)	219.5	286.7	217.6
Foundry equipment new orders index (shipments, 1947-49=100)	N.A.	110.3	134.0

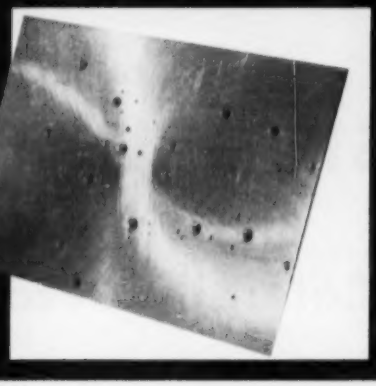
* Seasonally adjusted
N.A. Not available

PRODUCTION UP 300%





RAM MOVEMENT LAYOUT
PLAN VIEW



This amazing increase was accomplished at Technical Products, Hollywood, California, by installation of the BURGMASTER® 6-spindle ram type radial drill

Pictured above, at right, is the work, a base plate, which forms a part of an oil industry research instrument. By use of this highly versatile drill, it is now possible to drill, ream, tap, counterbore, countersink, etc., in one set up. The operator simply brings the spindle into position over the work, releases pressure on a button in the handle (located on turret head) and the machine automatically clamps ram and column. Saved is the time required to move the work from spindle to spindle, plus the time for new set ups; operator fatigue is greatly reduced.

In addition to being a radial drill, this machine can function as a deep throat production turret drill. Users are experiencing such important benefits as quick positioning, preset speeds and stops, time savings by elimination of quick change tools, which increases accuracy, and easy handling of holes up to ¼" in mild steel.

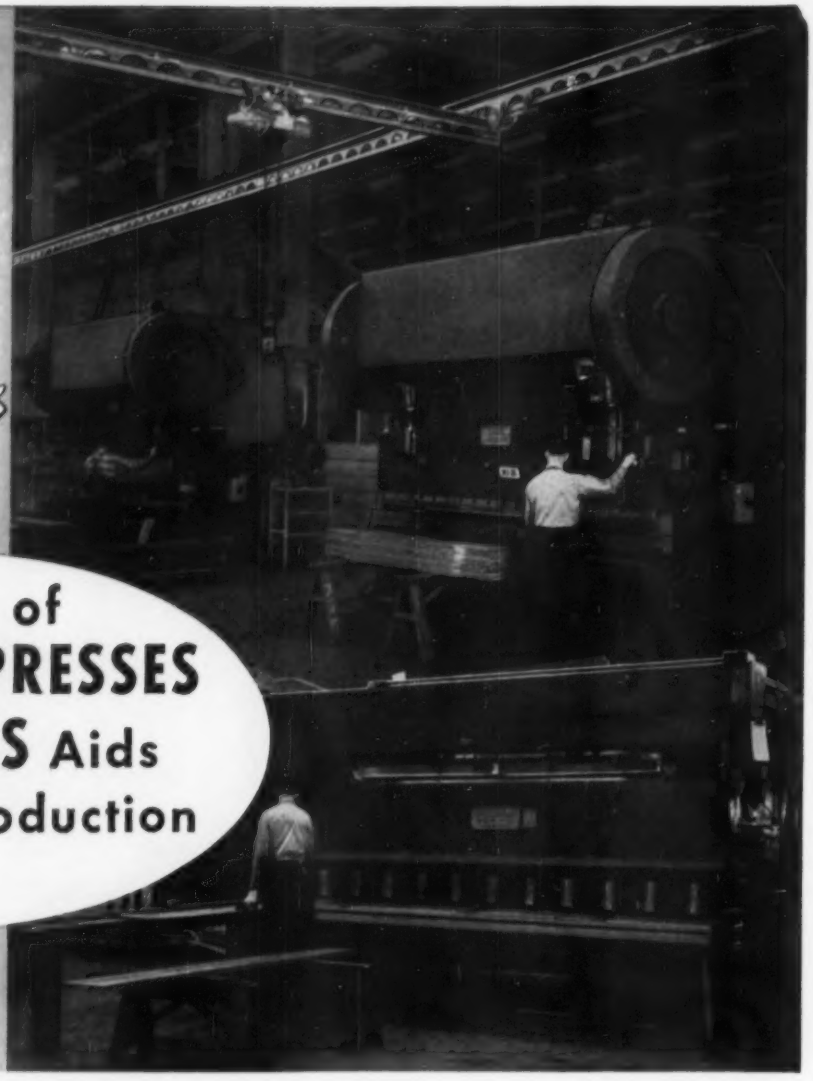
For complete information, write Dept. AM-10

BURG TOOL
Manufacturing Company, Inc.
15001 South Figueroa Street, Gardena, California

Sales Offices: **RIDGEWOOD, N. J.**—Burgmaster Eastern Sales Div., 86 N. Maple Ave., Phone: Gilbert 4-3002. | **CHICAGO**—Burgmaster Machinery Co., 5329 Lincoln Ave., Phone: UPtown 8-7161. | **SAN FRANCISCO**—Paul A. Kulju, 857 Estabrook St., San Leandro, Calif., Phone: LOckhaven 9-2244

Two of the Steelweld Presses in action. These are Model KS-10 machines rated for 12'-0" x ⅜" steel plate. Note how Cleveland Tramrail cranes serve these presses.

Battery of STEELWELD PRESSES and SHEARS Aids Caterpillar Production



Shearing long ½-inch thick strips into small rectangles on a Series 8D-10 Steelweld. The long extension squaring arm at front facilitates this work.

THOUSANDS of tons of steel of different thicknesses are sheared and formed on Steelweld Shears and Presses into various shapes required for the large volume of tractor equipment produced at the new Joliet, Illinois, plant of Caterpillar Tractor Co. These items include scrapers, rippers, bulldozer blades and wagons.

The heavy construction of Steelweld machines and many high quality features with which they are provided make possible continuous trouble-free performance. Their design includes a number of innovations which ease operation, speed production and enable accuracy to close tolerances.

The fact that Caterpillar has bought Steelweld Shears and Presses repeatedly and now has a large battery of them is mute testimony to the satisfaction they are giving.

GET THESE BOOKS!

Catalogs No. 1010 (Presses) and No. 1011 (Shears) give construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1450 EAST 281ST ST. WICKLIFFE, OHIO

STEELWELD

PRESSES and SHEARS

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Our Newest Growth Industry

A long period of steady growth looms ahead for the industrial-machinery industry. From here on, it cannot be viewed as a feast-or-famine business, but strictly as a growth industry.

This may sound at first like pie-in-the-sky talk. It has solid substance, however. Here are some of the facts:

The national economy . . .

is experiencing a tremendous upsurge in demand for capital goods of all kinds. Spending for new plant and equipment has soared to a new peak this year. Surveys show that this outpouring of money for new machinery will not diminish much, if at all, in the years ahead.

Outlay of dollars for research and development is going up at a dizzy rate. For all manufacturing industries, estimates put it at $6 billion in 1959 compared with $3.5 billion in 1953. As this activity intensifies, more new products are coming onto the market faster than ever. That in turn necessitates the spending of more money for new machinery with which to make the new products.

It means also that the useful life of machinery will become shorter as time goes on. Technological changes are coming so fast that machinery is obsoleted with amazing speed and is replaced by other machinery farther advanced in design, performance and results.

Bear in mind the prediction . . .

that more than one-tenth of the sales of U S manufacturers three years from now will be in products not made in 1955. Much spending will be done for machinery with which to make these new products.

Managements in general, and in Metalworking too, are planning their programs for plant expansion, modernization and new products farther ahead than ever before. Instead of plotting their course for six months or a year, or two years at most, they are thinking in terms of three years, five years, even ten years. Their commitments for plant and machinery are being made on this long-term basis. That in itself gives to machinery buying a certain stability formerly lacking.

Remember that the pressure to mechanize is terrific and will continue so. Mechanization is the key to greater productivity, which is essential if wages are to continue to mount without having an adverse effect on the economy. More mechanization means the use of more industrial machinery. The future demand is more likely to go up than down.

Growth of the industrial-machinery business and its increasing stability are having a far-reaching influence upon machinery builders. They have more money with which to carry on bigger research and product-development programs of their own, employ more engineers, add to plant facilities, and devise effective sales programs to use the new capacity.

The faster pace at which new products are being introduced contributes immeasurably to replacement sales, the area in which the greatest improvement can be made. If replacement's ratio to total sales were to double, the industrial-machinery industry would have a built-in business stabilizer of inestimable value.

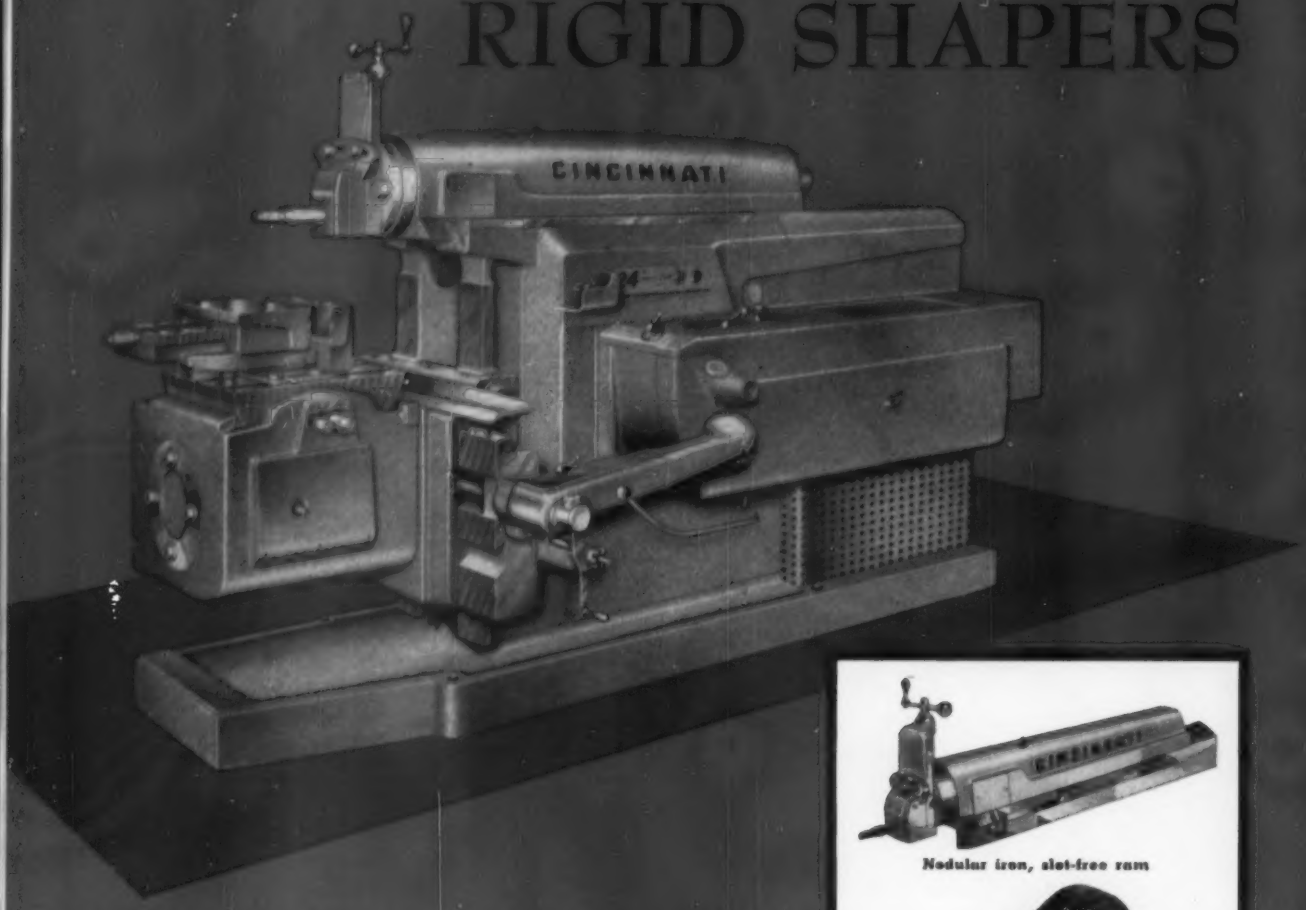
Our point is simply this . . .

It is time that we discard certain long-standing conceptions of the industrial-machinery industry. It is no longer the highly cyclical boom-or-bust industry that it once was. It has acquired stability and well-recognizable growth characteristics.

With this vital fact in mind, managements of industrial-machinery companies are confronted by an unprecedented opportunity in the next decade to grow bigger, to make more money for their employees, their stockholders and themselves, and, above all, to make a notable contribution to the American economy.

Burnham Finney EDITOR

CINCINNATI RIGID SHAPERS



New—modern—these Rigid Shapers offer faster, more convenient controls, greater accuracy, greater dependability. The New nodular iron ram, trunnion and vise, and wide, heavily ribbed column give a new rigidity—increase accuracy in cutting.

The New slot-free ram also eliminates the manual clamping of ram adjustment—a time saving feature.

A speedy, dependable electro-magnetic brake and clutch insure a faster performance.

50 P.S.I. pressure lubrication, exclusive on Cincinnati Shapers, is a real insurance against wear and a guarantee of long trouble-free performance.

Write for the circular on the New Rigid Shapers.

Nodular iron, slot-free ram

Electro-magnetic Clutch and Brake

The only shaper with 50 P.S.I. lubrication

THE CINCINNATI SHAPER CO.

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CINCINNATI

American Machinist

TRACER BORING of a portion of a big female mold for an F-102A nose radome is typical of jobs done on the 60-in. gap lathe. Note out-of-roundness of templet, followed by hydraulic stylus at rear of boring carriage. All controls are duplicated on carriages and on machine head. This photo was taken in the Axelson plant during test cuts (which show), but is a better view of the whole machine than can now be taken because of the building side wall (see cover of this issue)

"Invisible" radomes require very visible tools

WILLIAM E BRAHAM, vice-president, ZENITH PLASTICS COMPANY

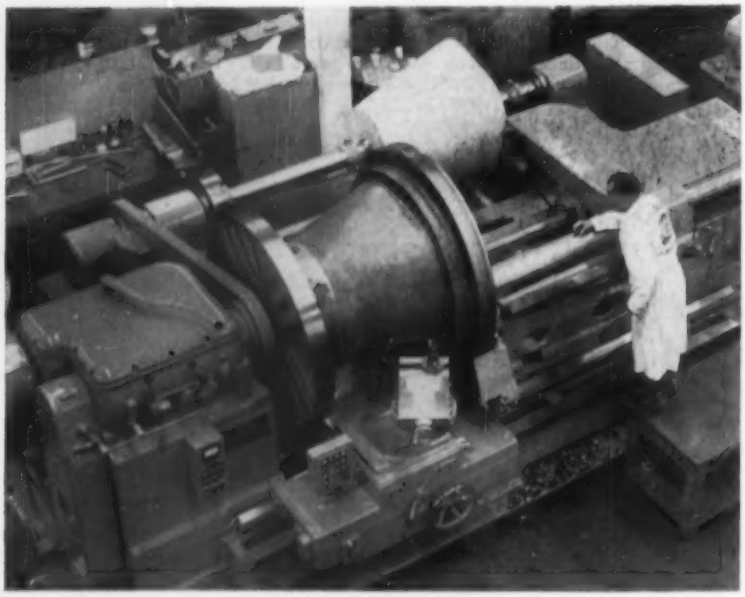
Reinforced-plastics components for fighter aircraft and guided missiles produced on out-size special machines at Zenith Aircraft . . . an indication of what's ahead for these materials

Certain reinforced plastics are "almost invisible" to radar—they transmit radar energy with relatively little loss in efficiency caused by deflections and reflections. Several countries have, as a result, developed guided missiles that are almost all plastic.

But plastics are light and cheap, dent and corrosion resistant, dimensionally stable, and easy to maintain, provide excellent surface smoothness (low air resistance), are more efficient, weight for weight, than common metals used in aircraft and guided missiles, particularly at temperatures over 300 F. Jet-compressor blades, molded to close tolerances, have withstood 500 F for 200 hr, 450 F for 1000 hr—better than metal and vastly cheaper. What's more, simple tooling on simple machines, with standard tech-

"Invisible" radomes require very visible tools . . .

THE SAME OPERATION, close up, at Zenith. Here, on the roughing cut, the out-of-roundness of the part is apparent, as well as coolant feed through the hollow boring bar, and the steadyrest on the forward end of the gap, which supports the outer rim of a mold during boring. Machining of large out-of-round molds on this equipment takes as little as 25% of the time usually required with conventional methods and machinery. Male halves are made in one piece, female in two, each 4 to 5 ft long, because of the 5-ft limit on boring depth. Rough cutting, finishing, and polishing are all done in the lathe



HERE THE 1:1 CHAIN-DRIVEN TEMPLET, and turning carriage are more distinguishable. Tool and stylus are in the same horizontal line. 3D templets, which may be plastic or plaster, depending on shape and size, are an exacting job because they control finished-mold shape. They are called "splash" templets, are pulled or cast from a master, hand-polished to required dimensions. Templet is hand-polished to desired tolerance; accuracy achieved is a function of time spent in polishing. The lathe machines within ± 0.005 in. of the templet. Flat templets may be used for cylindrical parts, of course

niques, can turn them out. Hence turbojets for pilotless aircraft include blades and compressor housings of plastic, are made in factory areas less than 20% those required for metals, with 25% of the personnel. Also in use are external rocket pods, rescue containers, rockets, and underwing tanks of reinforced plastics.

RADOMES AND WINGS

A major application thus far has been in radar housings themselves —as protection against weather in ground and sea units, and against air-stream buffeting in aircraft. Radar gear must be within the structure on high-speed aircraft and missiles; thus reinforced plastics must be used as integral structural components so the radar can "see out." Such applications stress the plastics as they would metals, but plastics parts are usually lighter and cheaper than equivalent metal. Wing or fuselage components are produced this way, but the most common structural element of any size is the radome, a "blister" on larger aircraft, and the roughly conical nose on fighters and interceptors.

Zenith Aircraft, Division of Zenith Plastics Co, Gardena, Calif, is the largest plant making this kind of equipment. Specialized units have been installed there to do the work, of which three items are noteworthy.

MOLD MAKING

Matched metal molds (usually cast steel of 94-97 R_b hardness), both a male and a female for each part, are made up to 60-in. dia by 16 ft long and weighing 10 tons. While cross-section is roughly circular, it is not necessarily so. To machine such molds, Zenith engineers worked with Axelson Manufacturing Company, division of U S Industries, Inc, to develop a 60-in. special sliding-bed gap duplicator lathe with Turchan hydraulic-tracing equipment. This was installed in September, 1955, and is able to turn or bore irregular metal or plastic components or tooling to within ± 0.005-in. tolerance of the 3-dimensional templets used.

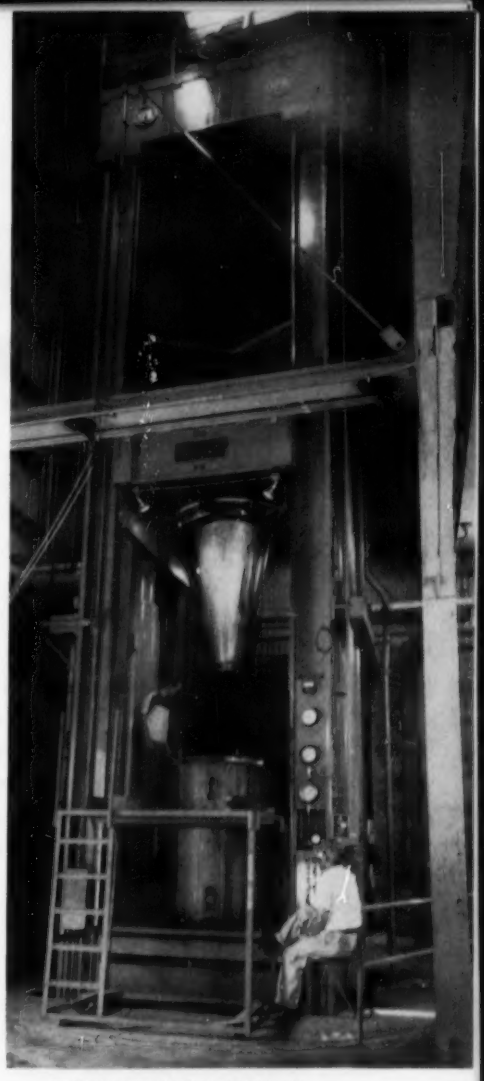
Operations are turning, boring, facing, and tracing, with cuts up to 5/8 in. and feeds of 0.005 ipr and above. Tungsten-carbide toolbits are standard, and speeds usually top at 100 rpm (1600 sfpm max). Parts may be up to 60-in. dia by 180 in. long, and weigh up to 10 tons, but can be supported only on centers, or on rollers. Highly flexible design, moreover, makes machining of small parts practical. Boring can be done up to 48-in. ID, and either boring or turning at up to 6 in. out-of-round under tracer control for the full length of the piece. Finishes are within 100 mu in., rms, so very little hand finishing is required—important in mold making. The lathe, 30 ft long, 13 ft wide, and 9 ft high, weighs about 100,000 lb, and is mounted on a 200,000-lb concrete foundation to assure maximum rigidity and freedom from vibration. It is in a new 10,000-sq ft tooling building, and electrical control and power panels are mounted on the wall above it to give maximum floor clearance.

KELLERING

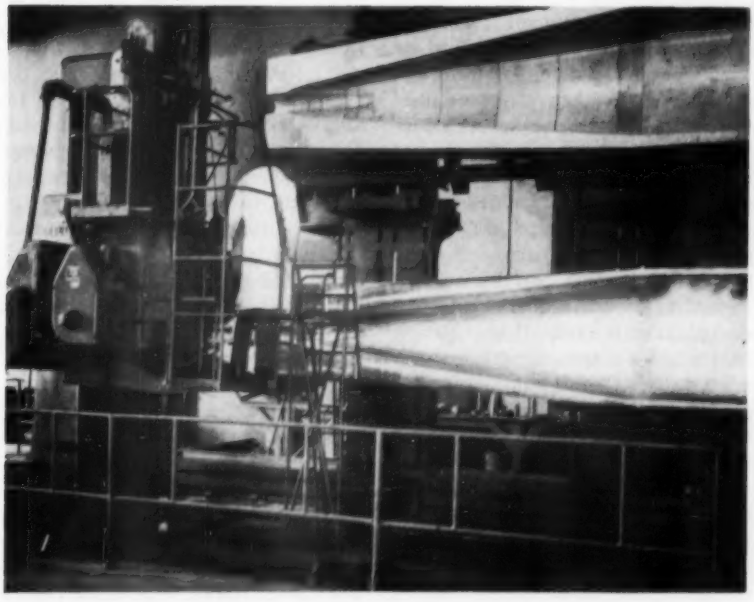
For huge tooling required for guided-missile wings, fuselages, aircraft-control surfaces, and wing and fuselage panels, a Model BG-22 Pratt & Whitney Keller duplicator has been installed in the same building. Also able to turn out reinforced-plastics tooling for major metal parts, it is the largest standard unit of its type, over 50 ft long, 18 ft wide, and 22 ft high. It weighs about 175,000 lb, stands on a 300,000-lb concrete foundation.

MOLDING

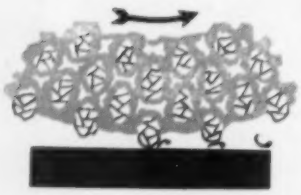
Most reinforced-plastics structures are molded by laminating glass-fabric reinforcement on a male or female form and impregnating with resin. Many high-volume, high-quality reinforced-plastics components such as certain "high-speed" nose radomes are molded by matched metal dies in a hydraulic press. Some of these components are more than 3 ft in dia by 5 to 9 ft long. To mold them, Zenith has installed a 600-ton HPM press, largest of its kind, that is roughly 10 x 10 ft x 71 ft high. It weighs 350,000 lb, is on a 700,000-lb foundation 30 ft below the floor. With 27 ft of daylight between top and bottom platens, it can handle parts up to 11 ft long. Clear platen area is 75 x 102 in. It is housed in a special building 50 ft tall, incorporates special Zenith patented features.



CLEAR PLATEN AREA of 75 x 102 in., coupled with daylight between platens of 27 ft, makes this the largest press for molding reinforced plastics. It is a 600-ton HPM unit, 71 ft high (almost half its height below the ground). Zenith had to build a 50-ft building around it. It is used in molding aircraft and missile nose radomes



WINGS, CONTROL SURFACES, panels, and fuselages are produced on tools made on this BG-22 Keller, largest standard unit of its type. It can produce a part 7 x 20 x 3 ft deep without resetting tracer or cutter heads



ANY GRINDING WHEEL IS A MULTIPLICITY OF SINGLE-POINT CUTTING TOOLS . . .

. . . and the space between the grits of a wheel have to be ample to clear the chips produced in grinding. Further, the manner in which grits are broken out of the wheel by the dressing diamond determines whether the wheel is to be a "sharp," efficient cutting tool, or whether it will merely burnish and overheat the work

What causes grinding stress?

JOHN HARRINGTON, chief engineer, grinder division THE DoALL CO, DES PLAINES, ILL

For some time, it has been recognized that any machining operation produces a work-hardened layer equal to 50% of depth of cut. In grinding, however, high temperatures generated at the work-wheel point of contact produce stresses of considerable magnitude. Because grinding is a finishing process, reduction of these stresses becomes a matter of concern. Causes and elimination are discussed

Research engineers at DoAll found that temperatures in excess of the melting point of steel, approximately 2700 F, are present between wheel and work at the instant of grinding, and that under the influence of either air or water-quenching, surface layers tended to crack. Many other organizations have also investigated these phenomena. Prof M C Shaw, of MIT, found as a result of his research on this subject, surface temperatures were present in the order of 3000 F. This was more recently corroborated by Prof John Wulff who found that instantaneous heats at a depth of 0.005 in. were in the order of 600 F, indicating that the structure of surface layers could be readily affected in this area.

Russian metallurgists at the I V Stalin Metalworks, Leningrad, found stresses promoted by grinding to reach as high as 60,000 psi. Other research men such as Almen discovered that in a grinding cut 0.002 in. deep across annealed strip steel, surface stresses in the order of 270,000 psi were generated.

These aggregate findings indicated that perhaps some of the difficulties with fatigue of components working under high stress might be a result of grinding technique. As a result, research was intensified in different parts of the country.

IMPORTANCE OF WHEEL STRUCTURE AND DRESSING

Other factors were found to influence the amount of heat and stress. One was the condition of the grinding wheel, bond, and method of wheel dressing, or preparing its grinding surface. Professor Shaw, together with several others, conducted a rather comprehensive study concerning the indirect effect of shape and condition of the dressing diamond upon the finished work, particularly in regard to the amount of heat generated. In this study, it was shown that when a diamond with a sharp edge, rather than a point, was presented to the wheel, larger numbers of pieces could be ground without burning the work. Conventional diamond points used for dressing the wheel resulted in only 11 grinds without burning. Another field survey of the performance of conventional diamonds indicated that wheels dressed with these diamonds produced only about five parts before they burned work. All tests were conducted on hardened 52100 steel with a hardness of R. 65, depth of cut 0.001 in., width of cut ½ in., and a table speed of 4 fpm.

It was found, where dull diamonds are used to dress wheels, that grits are either broken out of the wheel or are burnished by the diamond and their cutting edges made ineffective. Friction created by dulled grits in the wheel can therefore generate excessive heat and is one of the common causes of so called "burnt" work. When dressing, care should be taken to present an edge of the diamond rather than the point to the wheel if "dulling" of the wheel is to be overcome. Rotating the diamond 15 or 20° with each dressing will tend to keep it sharp in the same way that a pencil keeps sharp when it is rotated in use.

A grinding wheel is, in effect, a multiplicity of single point cutting tools, and the space between the grits has to be ample to clear chips produced in grinding. Chip space is regulated to a large degree by the fineness of the dress introduced on the wheel face. Where heavy deep cuts are to be taken, the wheel should be dressed coarsely enough to provide space for the increased chip load. A loaded wheel acts more as a burnishing wheel and can generate enough heat to melt the material and wipe it off rather

than cut it off in the form of minute chips.

Examination of grinding chips under a microscope establishes this fact. Chips produced by a badly dressed wheel will contain a great number of globules, generally of a dark blue color, indicating that melting has taken place. Chips produced by a wheel which has been dressed properly and where the work is cooled efficiently appear as though a miniature milling machine or lathe had produced them. Few, if any, globules are found among the chips.

DIMENSIONAL CONTROL AND PARALLELISM

Excessive heat in grinding also affects dimensional tolerances and parallelism. As heat is generated during surface grinding, it flows into the mass of the work and expands it. Because of heat buildup, the portion of the work which the wheel has not reached has a greater chance to expand. Consequently more material will be removed from that end, dimensional control becomes inconsistent, and parallelism is lost. Again, because heat buildup increases in proportion to the time the work is under the wheel, the objective should be to get the work done as rapidly as possible, to reduce if not eliminate expansion because of heat absorbed during grinding. For example, if there is considerable material to be removed, the wheel should be dressed coarsely and relatively heavy cuts taken. Because grinding will harden the surface of the work to a depth equal to 50% depth of cut, a coarse cut should be taken at first, and depth of cut reduced until finally very light cuts are taken. By this technique, the work hardened depth in the finished part is a few millionths of an inch, which will not be detrimental to the strength of the outer fibers. It is wise to redress the wheel for the light, final cuts. These cuts should be in the order of 0.0001 in. or less, thus reducing the work hardened depth to 0.000025 in.

Amount of crossfeed or width of cut is also important. Good practice is to follow the principle that crossfeed should equal between ¼ to ½ wheel face width. Smaller crossfeeds result in the work being kept under the wheel for longer periods, with consequent greater heat expansion.

COOLING METHODS

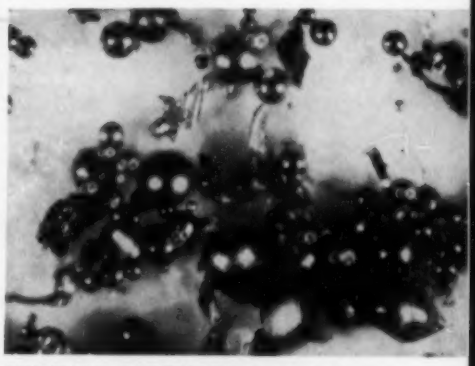
Conventional flood cooling in many cases does not work effectively because the coolant is deflected away from the point of workwheel contact by centrifugal air pressure in the order of 40 psi. Pressure of the water introduced through flood cooling is generally in the order of a few psi. The result is that at the point of grinding contact, no coolant is present and the bare metal is subjected to high temperatures. When the wheel moves on to another part of the work, coolant flows on to the overheated metal giving a very severe quench and promoting high surface stresses which cause grinder cracks.

To solve these problems many approaches have been made. The most successful take into account the laws of heat exchange. It is well known that the area of cooling medium surface presented to the heated part determines the rate of heat exchange, so the principles used in the past for cooling in air conditioning or fire fighting were adapted to cooling methods in grinding. Coolant was atomized so a larger, more absorbent area would be presented at the point of grinding contact.

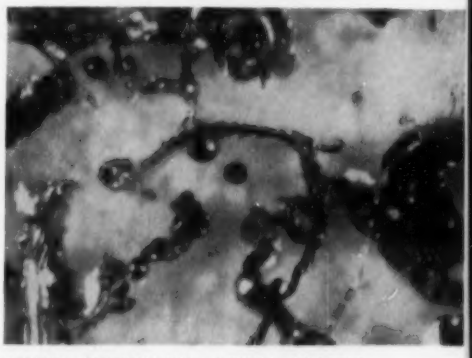
Various attempts have been made to apply atomized coolant. One utilizes an atomized spray directed at the point of grinding contact. In some cases, the air pressure barrier generated by the wheel prevents coolant from reaching the point of contact.

Quite a few years ago, it was discovered that rotation of a vitrified grinding wheel created a centrifugal-pump action whereby air was drawn in at the sides of the wheel and pressure at the wheel face could reach a value of 40 psi.

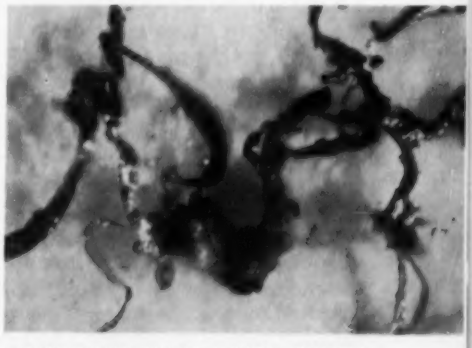
In one system, this effect is utilized by injecting water through the wheel hub, from which it is drawn through the voids in the wheel to emerge as droplets primarily at the wheel centerline. Special wheels are necessary here because of the



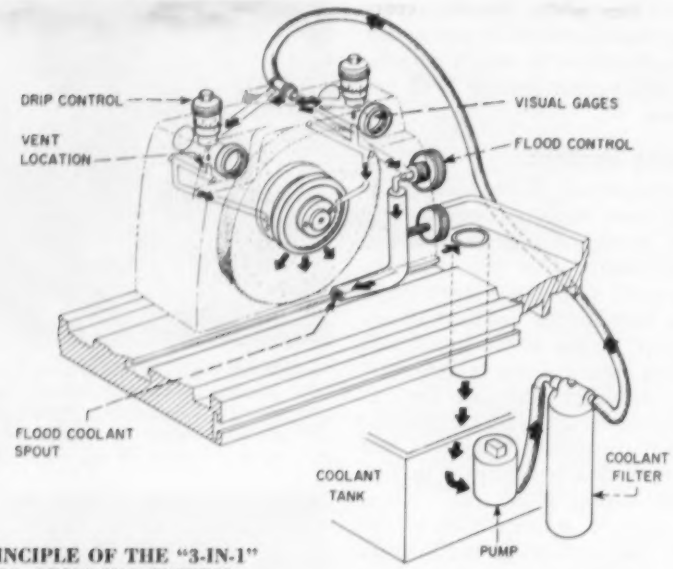
GRINDING PARTICLES obtained from "dry grinding" (without coolant). Note profusion of globules, absence of long chips and presence of many small ones, indicating excessive heating of the metal. 300X



CHIPS PRODUCED WITH FLOOD GRINDING . . . Telltale globules can still be seen here although not as much in profusion as in dry grinding. However, the considerable amount of globules is indicative that the air blast created by the wheel has been able to keep the liquid coolant away from the point of wheel-work contact. 300X



CHIPS PRODUCED WITH "COOL GRINDING" (DoAll system) wherein coolant is injected into the sides of the standard grinding wheel and flows through the wheel to emerge as a heat-absorbing mist right at the point of work wheel contact. Note virtual absence of globules and the long chips indicative of efficient cutting tool action such as it obtained on a lathe or a mill. 300X



PRINCIPLE OF THE "3-IN-1" COOL GRINDING SYSTEM

Coolant is fed into a manifold which is an integral part of the wheel housing. Coolant can be fed through calibrated valves to the side of the wheel where mist cooling is desired. Coolant can also be turned on voluminously and fed to the wheel under pressure for so-called "pressurized Cool Grinding"; frequently used in form grinding operations. Another valve permits flood coolant to be used either alone or in conjunction with Cool Grinding. Standard wheels are used, one of the advantages of this particular system

bushing required in the hub. Critics of this method claim that it is not completely effective because the edges of the wheel do the cutting in surface grinding rather than the center.

Another injection system* appears to overcome this limitation by injecting coolant into flanges at the sides of standard wheels so the leading edges receive a generous supply of atomized coolant. By this method, instantaneous temperatures are said to be reduced down to 1000 F, yielding a desirable temperature because it is below the critical point of ferrous metals. It also permits the grinder to exert enough force to accomplish work.

Improvement in the performance of parts operating under high stress can be expected with the adaptation of the cooling and dressing techniques so far achieved and anticipated for the future. Impetus to research in this direction is being fostered by the newest developments in propulsion engines.

Such institutions as Mellon Institute, Massachusetts Institute of Technology, some of the larger grinder and grinding wheel companies and other private corporations are continuing the research into these problems with the expectations that we will eventually be able to improve the materials and grinding methods to a point where parts can be subjected to stresses even higher than they are today.

* DoALL patented "Cool Grinding"

STRESS FAILURES FROM HEAT GENERATED IN GRINDING

Here's one of many interesting cases where control of heat generated in grinding has solved some rather baffling problems. The most outstanding case study centered around a jet engine where the shaft failed frequently and violently. Careful examination indicated that the work was highly stressed on the surface area. Because all such parts are normally under high working stress with a safety factor of about 2:1, it was anticipated that the full stress developed at peak loads would be in the order of about 70,000 psi. However, by X-ray refraction and accelerated deflection tests, it was determined that the initial stresses set up through grinding were in the order of 69,000 psi. However, the yield strength of the shaft material was around 130,000 psi, with the result that the instant the part was subjected to full load, the outer fibers received a stress in excess of the yield point. By improving grinding conditions, dressing of wheels and coolant application, these grinding stresses were reduced to less than 700 psi.

DIE PRODUCTION INCREASED 400%

In the production field, a larger producer of stamped parts found that improvement of cooling and wheel dressing techniques in grinding and re-sharpening of dies, increased production time between grinds from a minimum of 30% to as high as 600%. Over-all average for three years was 400%. Die failure was a very important factor to this manufacturer, because many of the dies were intricate and setup time ran into hours, sometimes into days.

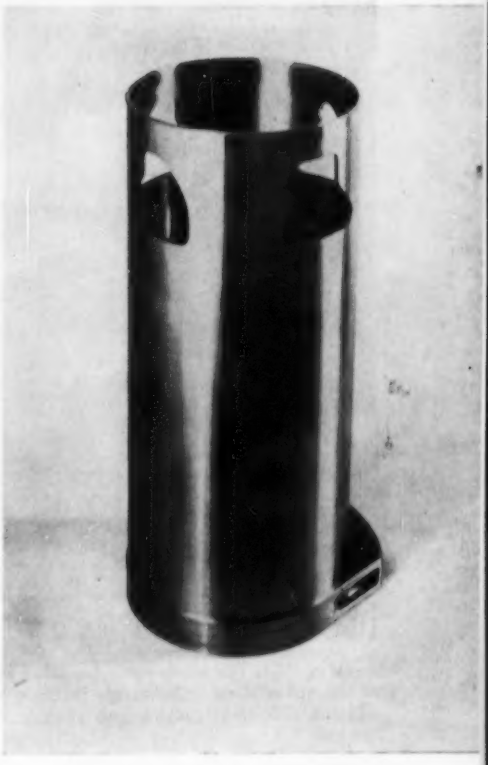
SURFACE STRESSES REMAIN

Research conducted by the Timken Company with the assistance of the Bureau of Standards offers some interesting sidelights on the problem of residual stress. Steel parts kept for a period of 25 years were examined by X-ray refraction to determine the amount of surface stresses still present. After the surface was etched to a depth of 0.004 in., stresses still remained at the magnitude of 10,000 psi. With the residual stresses still remaining, it was determined that about 30,000 years would be required before these stresses were completely relieved.

CRACKS IN GRINDING

Surface cracks resulting from grinding can be eliminated with considerable ease if the proper grinding techniques are used. As an example, one manufacturer who was grinding flat surfaces of 1020 steel, carburized, was unable to finish the stock because of severe grinding cracks. Reducing depth of cut down to 0.0003 in. did not solve the problem. Finally, by changing the method of applying coolant, and adapting better dressing techniques, it was possible to grind the material without producing cracks, even when cuts as heavy as 0.010 in. deep were taken.

Four high-frequency generators, producing upwards of 20,000 cycles per sec each are individually connected to four spark-cutting heads mounted horizontally and 90° apart at the top of a circular worktable. Each head is equipped with an electrode made from brass tubing having an 0.080-in.-thick wall and shaped to the desired opening. Electrodes are 0.004 in. undersize all around. An automatic servo feeds the tool. Cylinder liner is clamped on a central axis of the table, positioned within 0.0004 in. Table also serves as an oil reservoir. Machining cycle is automatic, started by a single operator who presses a button to simultaneously actuate the four heads. When cycle is complete, heads retract and machine stops



Complete machining time for the two intake and two exhaust ports is six min. (Of course, increasing the number of heads would not affect this time.) An additional six minutes are needed for loading and unloading, for a total floor-to-floor time of 12 min. Cylinder is 18 in. high, 7 in. dia; intake port has a 5-in. perimeter and exhaust port perimeter is 8 in. Rejects, burrs, and distortion are eliminated

Spark setup solves production strangler

When burrs, distortion, and heat-treat disintegration, plus excessive grinding time, skyrocketed costs on this precise and critical sheet-steel engine-cylinder liner, manufacturers turned to electrical-discharge machining. Not only did they solve the problem, but the saving paid for the entire setup in one month.

Builders of the Hercules aircraft engine, manufactured under Bristol license, use a hardened, alloy-steel cylinder liner which oscillates within the engine cylinder to provide gas intake and exhaust, thus replaces the conventional valves. Dimensional and physical requirements are exacting. Engine is a 14-cylinder radial, developing 1400 hp.

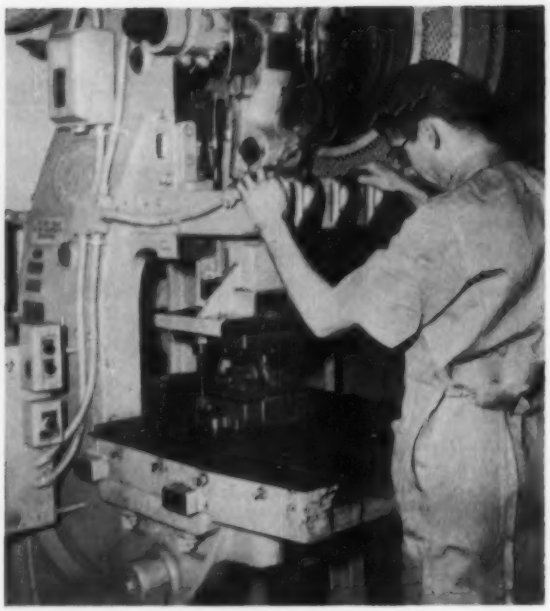
Formerly, the four port openings in the liner were stamped in a rough, soft-steel cylinder which had a wall thickness of 0.360 in. Stamping was a fast operation but eleven successive operations were needed to make the part usable afterward. These steps included: ID and OD grinding, heat treat, deburring, straightening, and further grinding to remove disintegration caused by heat treat and stamping.

Because the alloy is very tough, punches and dies had a very short life. Rejects ran well over 10%, even with constant care and close supervision.

To overcome the problem, engineers decided to use a battery of four Abaco electrical-discharge machines feeding into a setup on a single central table. After hardening (Nitride) to Rc 65, and grinding within a tolerance of 0.0015 in., the completed 0.160-in.-thick sleeve wall is spark-drilled. The four shaped ports are completed in one operation and the other eleven operations are eliminated.

Total time saved is 237 min. per piece, of which 182 min. is grinding time. This saving amounts to more than $50.00 per liner. Furthermore, parts are burr-free, surface finish is superior to that following stamping and heat treat, and there are no physical or chemical changes in the hardened metal. Rejects have been reduced to zero.

Die is loaded with die slide in the "out" position, free of incumbrances and the danger of the ram accidentally descending. Note two micro-motion switches between the uprights of the press. These switches are in series with the air clutch and the slide must contact both of them before the ram can descend.



Pressing the "run" buttons causes an air cylinder to position the slide under the ram and contact the switches, which automatically actuates the ram. If the slide is misaligned, the press will not operate. In addition to serving as a safety device, the slide improves production by reducing operator fatigue and simplifies positioning work in the die

Die slides for safety also boost production

At Douglas Aircraft and at McCulloch Motors, Los Angeles, specially designed die slides mounted on inclinable presses are responsible for marked increases in production. Of particular interest is that this higher output is as much a result of psychological factors as it is of mechanical improvement

KENNETH SANDERS, design engineer, E W BLISS COMPANY, SAN JOSE, CALIFORNIA

Press operators, when loading blanks under the ram of a press, tend to work methodically but with a degree of caution that makes the operation slow. When the cause of operator apprehension is removed, however, by moving the die out from under the ram for loading, the operator feels free to work more rapidly.

Die-slide equipment, if you are not familiar with it, is most simply described as a bolster plate on a slide, timed with the operation of the press ram, so that when the blank is being placed in the die the slide is out from under the ram. When the work is to be done, pressing the buttons causes the slide to be pulled under the ram by an air cylinder before the ram descends.

Die-slide equipment, primarily, is designed to increase operator safety. However, it also results in faster operation and more effective use of the press stroke. With the slide in the loading position the operator need not put his hands under the ram.

In addition, when loading the press with the slide out, the operator has a clearer view of the die, which means he can load faster and he can see any foreign material which may have been left from the previous stamping. The slide moves into position quickly for each operation and the action does not disturb the part, as both ends of the operating cylinder are cushioned to reduce shock.

More effective use of the press stroke is achieved with a die slide because clearance, for removal of the work, is no longer a problem. When used with parts having ample clearance, finished-piece ejection can be done with air, just as in conventional operation. The die slide also lends itself to a simple

and efficient screen guard, opened at the front just enough to permit movement of the slide.

The basic problem in engineering a die slide is to work out a foolproof electrical circuit, which will prevent the press ram from descending except when the slide is in the proper position. On modern presses, this problem can be solved with either of two clutching systems: air friction-clutches or positive clutches.

On air clutches, the versatility of the electrical controls are readily adaptable to die-slide operation. Standard control for operation of a die slide using an air friction-clutch starts when the operator depresses two "run" buttons connected with the electrical circuit. The die-slide solenoid air valve is de-energized, to bring the slide into position beneath the ram. When the die slide is in register beneath the punch it makes contact with two micro-motion switches, which are in series with the air clutch, allowing the ram to descend.

After a complete stroke, the die-slide air valve is again energized and the slide returns to the loading position. This control circuit meets all safety requirements. If power fails, the slide stays in; if air fails, neither the air clutch nor the cylinder will move. With the close adjustment available on the micro-motion switches, any slug or foreign matter preventing the slide from registering will prevent actuation of the press ram.

Standard positive clutches, such as the "rolling-key" clutch, present a similar problem, with the additional complication that once the press ram is triggered a complete stroke must be made. This will occur as long as the flywheel is turning, even though the power fails. Thus, to be sure that the die slide cannot move once the press is triggered, a locking device on the slide is needed to prevent it from moving until the stroke is complete.

With positive clutches, the control circuit operates the slide first, bringing it into position and closing one or two micro-motion switches to operate an air trip for the clutch. This circuit, cam controlled, will not release until the ram has completed its stroke. Thus, "locking in" of the slide is assured. In addition, the air trip actuates a locking pin into the slide, to prevent movement of the slide until the stroke is complete.

Originally, die slides were developed as a safety measure, to prevent, or eliminate the need for, the operator putting his hands under the punch. However, in many plants now using them it has been found that presses so equipped show a decided increase in production. First, the operator need not fear the ram, hence he can work faster. Also, because tote boxes can be placed on either side of the slide in loading position, operator arm motion and "reach" are reduced. The latter factor affects both time and fatigue. In addition, the open view of the die provides for more accurate positioning of blanks in the die and cleaner work. As a further benefit, die slides lend themselves to automatic loading and unloading.

Pressure-sensitive stencils cut engraving cost 85%

Paper and cloth tapes using pressure-sensitive adhesives have found application in an amazing number of tasks. Now, one more use has been added to the fold—with a fantastic saving in engraving costs.

The Herman J Wolf Company, Philadelphia, manufacturer of religious articles, now uses custom die-cut adhesive stencils to place inscriptions on cups, chalices, and other articles of metal. Formerly, skilled engravers cut these inscriptions by hand. Today it is simply a buffing operation.

After cleaning and polishing the surface in the general design area to a bright finish, the die-cut pressure sensitive tape is applied and rolled into place with a squeegee, with particular emphasis to insure adhesion of the tape around the edges. With the tape securely in place, the article is buffed to a satin finish all over, using a cloth wheel rotating at slow speed, together with an abrasive compound.

When the tape is peeled off, the letters under the stencil or mask have a bright sheen in contrast to the satin surface remaining on the rest of the object. After removing the tape the job is completed by cleaning and lacquering the piece.

To overcome the cost and thickness problems of cloth-backed tapes, especially thickness, which prevents a sharp outline, the Gleicher Manufacturing Corp, Newark, NJ, developed a special, thin, paper-backed tape which was not only strong, less expensive and applicable to surface contours, but resulted in clean, sharp letters.

Tapes can be backed with paper, cloth, synthetic films, and laminates of a number of materials, to give a multitude of properties. Die-cut tapes for "engraving" can be used on compacts, lipstick holders, mechanical pencils, and stainless-steel food equipment. Glassware manufacturers can provide, inexpensively, decorative effects by using these stencils in conjunction with sandblasting.

How to APPRAISE ACCURACY IN MEASUREMENT

cost and common sense enter into the establishment of accuracy objectives, an increasingly pressing problem as tolerances get tighter. Here are 48 pointers to help you evaluate the five elements in measurement—workpiece, measuring or gaging instrument, the reference standard, environment of measurement, and the human element ever present

COL W J DARMODY
(USA Ret'd), technical consultant,
THE SHEFFIELD CORPORATION,
DAYTON, OHIO

48 Pointers for

1.. WORKPIECE

- (a) Clean and free from burrs
- (b) Temperature equalization with instrument and standard
- (c) Essential points of measurement
- (d) Accuracy objective proportional to size
- (e) Geometrical truth of supporting features
- (f) Consistency of errors in related features such as pitch diameter to lead in threads
- (g) Geometric truth such as out-of-round sufficient to assure repetitive readings within accuracy objective
- (h) Deformations from support conditions
- (i) Elastic indentation of measuring contacts
- (j) Effects of thermal expansion between measuring temperature and standard 68 F
- (k) "Hidden geometry" such as lobing that will not be detected by contact conditions

2.. INSTRUMENT

- (a) Adequate amplification for accuracy objective
- (b) Amplification checked under conditions of use
- (c) Effects of friction, backlash, hysteresis, or zero drift
- (d) Electrical, optical or pneumatic input to amplifying system functioning within prescribed limits
- (e) Contact geometry correct for both workpiece and standard
- (f) Contact pressure control functioning within prescribed limits
- (g) Contacts in correct geometrical relationship and inspected for wear or chipping
- (h) Slides, ways, or moving elements not adversely affected by wear or damage
- (i) Deformation effects in instrument when heavy workpieces are measured
- (j) Auxiliary elements such as wires, rolls, angles, plates, calibrated and checked for function
- (k) Magnification of diameter error in thread wires when positioned in thread form

Almost daily the designer, the metallurgist and the process engineer establish higher product performance goals. These have to be met not only with higher standards of accuracy and dimensional precision, but also with the means, methods and tools to measure that precision through all stages of production, to whatever degree of conformity and refinement is required.

As a result, we are developing an entirely new set of standards both for appraising accuracy as a highly essential attribute and for precision inspection and certification of accuracy. This is being accomplished by constant improvements in gaging tools and measurement techniques.

The average person, to whom an inch is still an inch, finds it difficult to understand why accuracy and precision are so persistently studied and restudied in modern industry. He would find it almost incomprehensible that many of industry's measurement problems today have grown so vast, varied and complex that solutions require all of the scientific and engineering skills and resources we can muster.

Our basic standards are still the same. Accuracy is, generally speaking, "the quality of conformity" and precision is "the quality of refinement." But the big and complex job of refining and measuring accuracy to tolerances as close as millionths of an inch, wherever industry requires it, has put the whole technique of industrial measurement in the "graduate-school" class.

So many industries either consider millionths of an inch as a "must," or at least a desirable objective, that dimensional measurement is being forced to develop a host of new techniques and devices in the

Appraising Accuracy in Measurement

3.. STANDARD	4.. ENVIRONMENT	5.. HUMAN ELEMENT
(a) Precision proportional to accuracy objective of workpiece measurement	(a) Standard measuring temperature is 68 F	(a) Training
(b) Calibration by authoritative laboratory	(b) Temperature equalization between standard, workpiece and instrument. Deficiency of one degree in equalization could introduce error of 6.5 millionths per inch of size	(b) Skill
(c) Application of calibration corrections	(c) Thermal expansion effects from heat radiation from lights, heating components, sunlight, and people	(c) Sense of precision appreciation
(d) Effects of wear, damage, burrs, or dimensional instability since last calibration	(d) Effects of cycles in temperature control	(d) Complacent or opinionated attitudes towards personal accuracy achievements
(e) Thermal expansion effects of materials	(e) Impinging drafts of air may introduce thermal-expansion size errors	(e) Open-minded, competent attitudes towards personal accuracy achievements
(f) Effect of modulus of elasticity on contact indentations	(f) Manual handling may introduce thermal-expansion errors. Human temperature is 30 F higher than standard measuring temperature. Could affect error in one inch of steel up to 0.0002 in.	(f) Planning measurements techniques for minimum cost, consistent with precision requirements
(g) Effects of flatness, parallelism, wear or warpage of gage blocks as they function in measuring contact	(g) Clean surroundings and minimum vibration enhance precision	(g) Appreciation of scope of accuracy evaluation which may be more or less than listed in columns 1, 2, 3, and 4.
(h) Long end standards supported at points to minimize deflection effects	(h) Adequate lighting	(h) Ability to select high-quality measuring instruments and standards with required geometrical and precision capabilities
(i) Effects of clamping force on gage blocks used with holders or attachments		
(j) Effects of differing geometrical form between workpiece and standard as they function in measuring contacts		

research laboratory. To meet this demand and to help industry plan for future demands, the Sheffield Corporation, for example, now has in full operation the world's only private measurement facility comparable to leading governmental standards laboratories.

Achievement of accuracy and precision is not the job of the laboratory, or the tool and instrument technician, alone. Its accomplishment in the fullest sense requires a constant consideration and re-evaluation of objectives, standards and environment, as well as close attention to human attitudes and elements contributing to industrial skills. A detailed resume of these elements and considerations is contained in the evaluation chart "48 Pointers for Appraising Accuracy in Measurement."

The chart makes it clear that while the accuracy objective may be *defined* fairly well, the appraisal of the accuracy of measurement actually *attained* is involved and interwoven with a number of facets of the measuring technique. Generally our laboratory and engineering studies show the appraisal of accuracy requires a balanced evaluation of errors or possible errors. These may arise in or be due to these factors:

1. The measuring instrument
2. The standard used to set the instrument
3. The workpiece (its geometrical limitations, etc.).
4. The environment (temperature, etc.).
5. The person performing the measurement (the human element).

The chart lists under each of the five elements a group of questions or matters of decision that may

be useful in whole or in part for appraisal of accuracy.

A balanced evaluation of the potential or possible errors in these five elements might be defined in whole as skill in measurement. Careful appraisal of these five elements should precede any decision as to an accuracy objective actually attained in a measurement task. This detailed appraisal, while more or less automatic to skilled measurement technicians, process engineers and veterans of precision operations, should be useful in indoctrinating and training supervisors and workers who may be comparatively new to many modern precision gaging and measurement demands and processes.

PARADOXES IN ACCURACY

At all levels of decision and operations, most of us are familiar with what seem to be paradoxes in accuracy and precision standards demands and methods. These paradoxes, or rather, differences in objectives, invariably determine the nature of our accuracy and measurement appraisals.

For example, a precise reading taken on a sensitive measuring instrument may not always be an accurate measurement. So here the question of objectives becomes paramount.

If inspection is performed with gages, the accuracy objective may be stated as a gage tolerance on a tool or gage drawing or in a standard such as ASA-B1.2 for thread gages. When gages are inspected, the gage checker established an accuracy objective for his measurements with respect to gage tolerance.

Where parts are accepted with measuring instruments, rather than gages, the inspector must establish an accuracy objective in order to evaluate conformity of the product to the requirement. How much should the accuracy objective be in terms of the tolerance involved in the acceptance decision is well defined in some cases such as gage standards.

In other cases the establishment of the accuracy objective is rightly a matter for the measurement laboratory, such as Sheffield's new El Whitney Metrology facility. If the accuracy objective is a large fraction of the part or gage tolernace, it may lead to acceptance of defective material or rejection of good material. Uncertainty of measurement may encroach upon product limits. Recognition of this effect of uncertainty of measurement, ie accuracy, usually results in efforts to limit accuracy of measurement to 10% or less of the tolerance of the feature being measured. Having established the accuracy requirement for a measurement task, the next problem is to appraise the accuracy actually attained in the measurement techniques. The abundance of high-amplification measuring instruments that have become available, to meet the ever narrowing production tolerances, has emphasized the necessity for *differentiation between sensitivity* of the measuring device and the accuracy of *measurement actually attained*. Exhaustive laboratory tests can best make these determinations for industry.

Costs and common sense, of course, enter into the establishment of all accuracy objectives. A precision of measurement not compatible with the tolerance of the feature (part) to be measured, can lead to excessive costs and a high incidence of rather futile borderline acceptance problems. An example of such metrological extravagance would be efforts to attain an accuracy of measurement of ± 0.00001 in. on a feature having a tolerance of ± 0.002 in. On the other hand, an accuracy of measurement of ± 0.001 in. on this tolerance would default precision.

The test-fee schedules of The National Bureau of Standards or The Eli Whitney Metrology Laboratory for gages are a guide to the establishment of precision accuracy objectives. A classification of cylindrical-gage tolerances used by American Gage Manufacturers is another reference for establishing precise accuracy objectives. See Table I. These tolerances represent the permissible variation in the sizes of gages. To insure that these tolerances are actually fulfilled, the gage laboratory must measure to an accuracy of a fraction of the tolerance. "Tithing" of the XX gage is a precision challenge.

An article on the subject of "One Ten Millionth of an Inch," by Dr I C Gardner, appearing in the May-June 1955 issue of *Ordnance*, is a most useful appraisal of gage-block accuracy objectives of the National Bureau of Standards. In the less precise echelon of measurement, the accuracy appraisal is concerned with fewer and simpler matters than are necessary to attain accuracy to the seventh decimal place. When all causes of error are considered, such as are involved in measuring a class XX cylindrical gage or a class W thread gage or a mechanical comparison measurement of working sets of gage blocks, there are a fairly large number of decisions or questions to be resolved in appraising the accuracy objective.

Table 1 . . SIZES AND TOLERANCES OF CYLINDRICAL GAGES

SIZE RANGE Above	To and Including	Class XX	Class X	Class Y	Class Z
0.030	0.825	0.00002	0.00004	0.00007	0.00010
0.825	1.510	0.00003	0.00006	0.00009	0.00012
1.510	2.510	0.00004	0.00008	0.00012	0.00016
2.510	4.510	0.00005	0.00010	0.00015	0.00020
4.510	6.510	0.000065	0.00013	0.00019	0.00025
6.510	9.010	0.00008	0.00016	0.00024	0.00032
9.010	12.010	0.00010	0.00020	0.00030	0.00040

Flute cutting 60 years ago . . .

SIXTY YEARS AGO, drills were grooved by hundreds of machines like those at left—a specialized form of miller with twin cutters in most cases. Machines of this type, but vertical, are still used for larger drills, but smaller ones are flute-ground from the solid hardened stock. Below is a new battery of ten grinders for drills from ¼- to ½-in. dia, a recent development. There are also 18 machines based on the same principle for smaller drills. Overhead exhaust is for fog generated by the high-load cutting. Coolant is handled under the floor

. . . and today

New twists make drills

Here we report a visit to Morse Twist Drill & Machine Co, New Bedford, Massachusetts, that unearthed three very interesting new ideas: one in high grinding rates on hardened steel, another in electronic control of a thread grinder, the third in automatic counting and packaging of tools

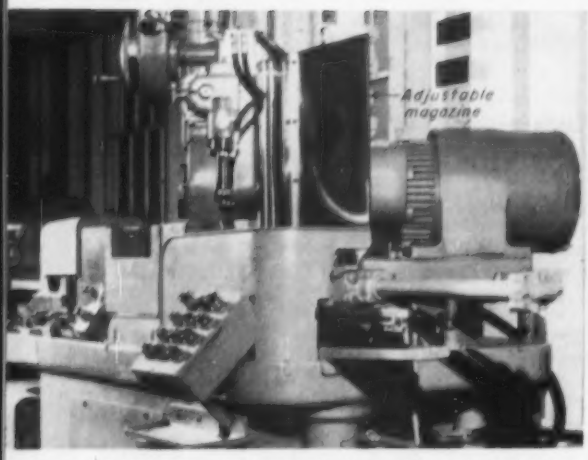
E J TANGERMAN, executive editor

Just 60 years ago, an *American Machinist* editor visited—and later described in print—the plant of Morse Twist Drill & Machine Co, New Bedford, Mass. Twist drills had been first manufactured only 30 years before that, by Stephen Morse, so our editor recalled the flat, forged drills of all sizes, the visit to the toolsmith, the "eccentric and erratic grindstone," while he tried to "hold a pair of hinged calipers in his mouth and at the same time swear with sufficient fluency to do justice to the situation."

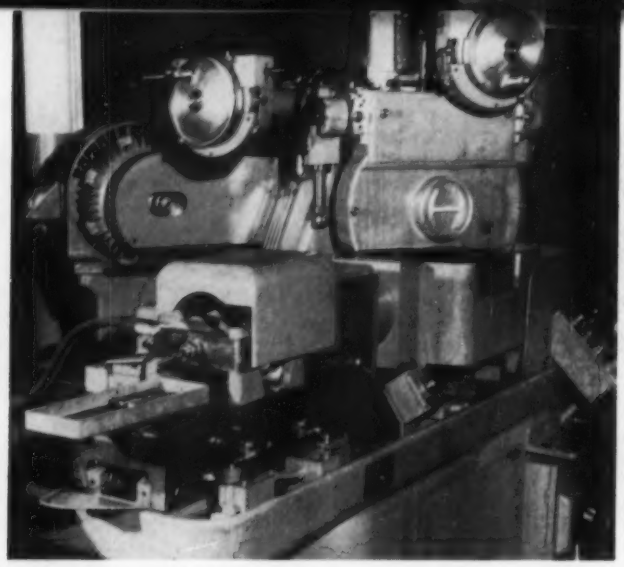
He went on to describe the "highly intelligent" workmen, the English steel, the three new Brown & Sharpe anthracite-fired annealing furnaces which replaced ten that burned twice as much coal each, the "mercurial" thermometers on quench tanks that were tested frequently in boiling water and found to be off as much as 6 or 7°.

Drills were grooved by millers, vertical for larger drills, horizontal for smaller—"hundreds of drill grooving machines arranged in long rows" (see headpiece photo). Straightening after heat-treat was a major operation, involving Bunsen burners and hand screw presses. But the article mentioned a number of recent changes to expedite the processes.

Drills are still—as they were then—the most heavily loaded cutting "bits" in Metalworking, and one of the most widely used, yet made by specialist companies so the average shopman has never seen one produced. It seemed interesting, therefore, to go back to New Bedford 60 years later, to see what recent changes have been made. There were three major and



LOADING . . The magazine has guides adjustable for blank length. Control board, coolant exhaust and feed cylinder are in the foreground, the wheel motor at upper right



OPERATING . . Web-ground drills pass through the hollow spindle, shank end first, to emerge as shown, and drop into a tray. Dial at top center adjusts wheel position and controls its feed, that at upper right controls the two dressers, which are on arms extending out at each side of the wheel guard

New twists make drills . . .

recent ones—in drill grooving, in tap grinding, and in drill packaging—that seemed to hold ideas for other applications, plus the endless changes to be expected in a 60-year revolutionary period. As the editor concluded so long ago, "changes are constantly going on as improved methods of doing the work are devised, and it is expected that a number of changes will take place within the next few years." Here, then, are some of the changes going on *now*.

Perhaps most noteworthy of the three major changes in method is that of making drills from solid, heat-treated stock in sizes up to ½ in. The twist drill has been produced in sizes up to ¼ in. by grinding from the solid for a number of years, but in larger sizes by milling or twisting stock of suitable cross-section.

Small flute grinders developed by Morse some years ago were made by Hertlein Special Tool Co, Mt Vernon, NY, drill-machinery specialist. This basic design was further developed by Carl Hertlein to produce the new larger-size machines. They are spectacular in rate of metal removal and in the degree of automaticity built in, the operator merely stacking heat-treated blanks in a magazine. The machine does its own wheel-dressing at every stroke and incorporates its own compensation for wheel wear, as well as feeding blanks through. Production rate is 5½ times faster for the ½-in. size (+460%), although two 4½-in. flutes (including runout) are ground in each drill. Assuming that 60% of the metal is cut away for a length of 4¼ in., we have a metal-removal rate of 0.41 cu in./drill, or 36 cu in. per hour!

Essentially, the blanks—which are ½-in. drill rod 6¼ in. long, rough pointed and hardened—are held in a hollow automatic chuck and fed into a slotted bushing under the grinding wheel by a form screw that also controls the helix of the drill flute. The form screw is rotated by an adjustable hydraulic motor.

At the completion of grinding on the first flute, the chuck retracts, indexes 180° for two-flute drills, then repeats the cycle for the opposing flute. After the second flute is ground, the chuck releases the finished drill while still in the forward position. At the same time a pusher rod feeds the next blank into the chuck and ejects the finished drill into a hollow spindle. As finished drills build up, they are ejected from the end of the spindle into a tray.

The wheel, 18 in. in diameter, is cog-belt driven by a 15-hp motor. (Stock feed is by separate hydraulic cylinder.) Motor and wheelhead are mounted on a table which can be swung to the desired helix angle.

Web thickness is set by a large vernier dial (0.0001-in. graduations) on the wheel slide, and maintained automatically by a synchronized feed of the twin diamond dressers on arbors extending in from each side. Once the machine is set up, the operator need only keep the magazine full. Interlocks prevent cycling when the wheel reaches too small a diameter. Stroke is adjustable for drill length by dogs on the machine front which operate the hydraulic valves on the table-slide cylinder. Rate of table feed is set by dial to suit materials diameter, wheel type, and stock. Thus the one machine, with changes of former screw, bushings, and feed magazine, can handle any diameter of drill from ¼ in. (or even less) to ½ in.

Accompanying photographs show most details of the machines, but several deserve emphasis. One is that flutes are ground singly and in one complete pass, with a cycle of 0.45 min for a ⅜-in. drill and 0.74 min for the ½-in. drill. Dressing of the wheel is automatic between passes, following downfeed of about 0.001 in. in grinding ⅜-in. drills, 0.0015 in. on ½-in. drills. There are two dressers, each working from wheel center around and out, so each diamond dresses a quarter circle. Wheel and dresser heads have separate feeds, so that,

initially, they may be adjusted independently; thereafter they are fed in synchronism by a ratchet and pick-feed rack. As the wheel wears, it breaks down faster, and web size could go off faster as a result. Automatic size control through the dresser prevents this possibility.

Despite original fears, once the machines were in adjustment, the grinding did not produce any visible burn. Because blanks are heat-treated first, there is no tendency for drill warpage, and flutes are both more uniform and far smoother than those produced by milling. There is no danger of off-center webs such as might occur from mis-matched cutters when milling both flutes at the same time.

Material is 62-63 R_c, so a flood of coolant is required on the 18-in. resinoid wheel. Burning was a major initial problem. Coolant pressure is 100 psi, and the fluid is a sulfur-base cutting oil, clarified on bypass in two 2500-gal tanks, one on each end of the underfloor system for the 10 new machines as well as other allied grinding equipment.

Rapidly developing, incidentally, is use of the black-oxide type of heat treatment. It leaves the drill with an over-all hard black coating of oxide, which increases the life of the ground-flute drills to such a degree that Morse has standardized on this treatment on all ground-flute drills. With the ground flutes, it results in a very smooth, lubricating, chip-passage surface.

AUTOMATIC TAP GRINDING

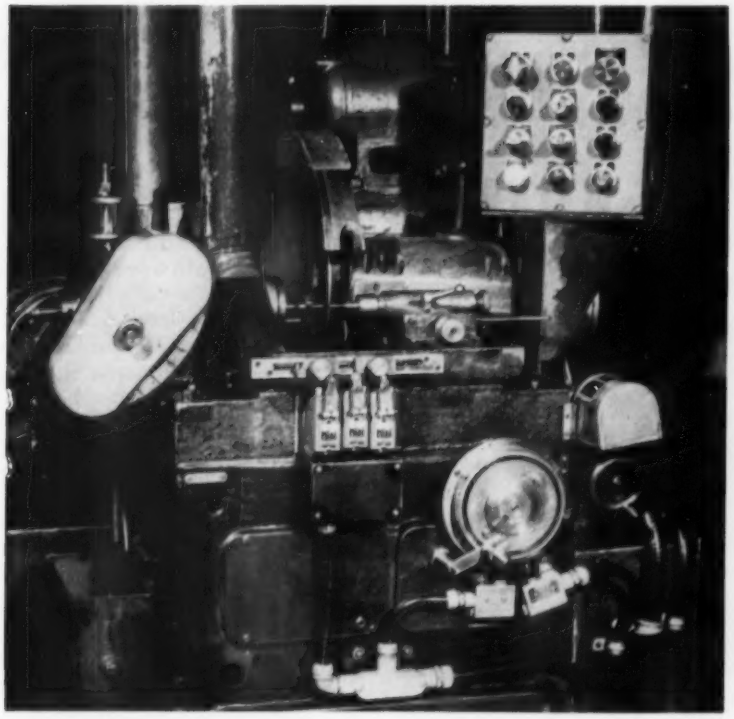
Tap grinders originally built at Morse were redesigned to include new automatic features, the most important being electronic control of feed and sizing to very close and consistent tolerances. This feature helps maintain a high production rate, yet makes it unnecessary for the operator to be constantly attentive to avoid off-size grinding.

Threads are ground from the solid with resinoid wheels, dressed to a single-thread V by twin diamonds. Tap stock, like drill stock, is a molybdenum high-speed steel, at a hardness of 62-64 R_c. Thread-grinding speed is governed by pitch and diameter of the tap blanks to be ground. Coarse-pitch threads are usually ground in 1 min, fine-pitch take about 1/3 longer. Tolerances are held about three times as accurately as by hand setting. Gaging is done by electronics, so the gage head itself never touches the work.

Micrometer control predetermines size at the pitch diameter, but an electronic bridge clears the feed circuit. Both the twin dressers and the measuring anvil are actuated by the same precision-ground screw (see photos), so there is no necessity for compensation between them. The screw nuts are preloaded to prevent backlash.

The cycle is roughly this: Rapid approach for roughing by a cam switch. At the end of the roughing pass, the wheel feeds in at a slow rate until balance is attained in the Wheatstone-bridge circuit. This drops out the feed contactor at a predetermined point, which sizes the tap. Then it rapid-retracts to the loading position.

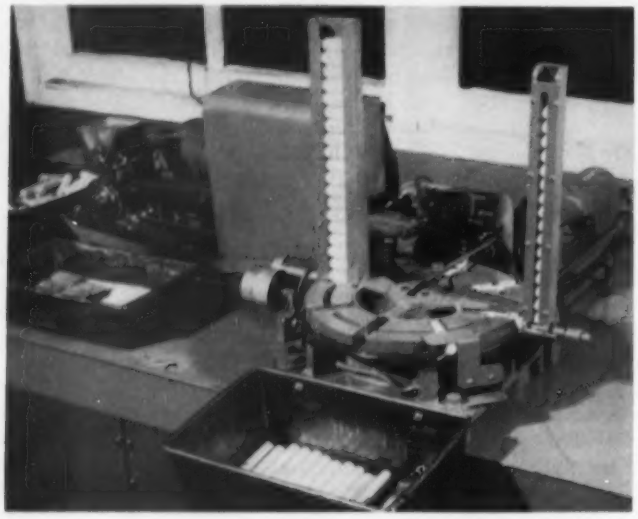
After a preset number of grinds,



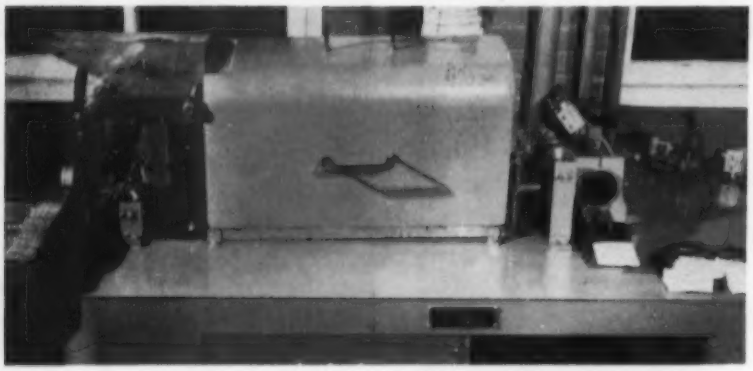
TAP GRINDER . . Not "prettied up" for sale, but strictly utilitarian, is this typical machine. Tap being ground is at upper center, micrometer head for PD control (manual) is at right center. Just below and to the left of it is the operating wheel for main feed—once set up, it is not used, a motor-driven ring behind it handling automatic feed. Dresser heads are at left

DRESSER HEADS . . There are two diamond dressers set at proper angle (in this case 60°) to each other and driven by the same shaft. Cams on the ends of the dresser shafts cycle them across the sides of the V. They do not operate after every pass, but after a predetermined number of passes

the dresser feeds in, the dressing motor starts and dresses the wheel, and the gage head is moved back an equal amount to compensate. Dressing pass can be varied to remove from 0.0005 to 0.010 in. of the wheel, but is usually not set to remove over 0.0015. Details again are pictured. This is the device which the company recently christened the "Vectormatic."



DRILL PACKAGER . . This is the smaller of two drill packaging machines, for drills under 0.070 in. Drills are placed in the adjustable hopper at left, are picked off singly by the drum below it and carried on bead chain through the oil spray hooded at center. The counter counts off an even dozen, then the plunger behind injects them into a wooden tube. Tubes are placed, opening to left, in the feed-chute at left, and enter the 8-position indexing plate (alternate positions not used). At second index, they receive drills, at fourth the top is pressed on by a plunger which takes it from the right-hand chute, and two indexes later a mechanical dog ejects the completed package. Plan is now to incorporate a size stamp or labeler so the job will be complete. At left are several interchangeable pickoff drums, each handling about three sizes of drills



COUNTER . . Larger drills are packaged by this semi-automatic machine. They are picked off singly from the hopper at left, carried through the oil spray, and dropped into the cylindrical hopper at right, after being counted by the switch at the end of the conveyor. When a dozen drills are stacked up, the machine automatically shuts off, to be reactivated when the operator trips the plunger that throws the dozen forward into an envelope. Note disk pairs (upper left) which are adjusted to drill size

AND NOW—PACKAGING

Automatic packaging might not normally be considered as a drill-maker's problem, but packaging small drills requires a lot of labor and is very subject to human error in the counting of even dozens, all day, every day. To solve this one, Morse is readying two packaging machines, one for very small drills that are packaged in small tubes, the other for those packaged in envelopes. The smaller has packaged eight dozen drills a minute, can do better. They are alike in that drills are loaded into hoppers, from which they pass singly along a bead-chain conveyor under a spray head for a corrosion-resistant lubricant, then to a hopper which collects a dozen. But here they differ. The larger, simpler one drops the dozen into a hopper, then stops until the operator trips the plunger which ejects them into an envelope which he prepares, positions and closes. The smaller one, however, counts out a dozen drills, pushes them into a tube, caps the cylinder, and ejects the loaded package.

Two forms of feeding and of counting devices are also involved. The larger machine picks drills from the hopper by a series of twin cams, each pair adjustable to fit the size of a single drill. It counts at the other end by a lever on a miniature precision switch. The small machine utilizes instead a barrel with a solid, slotted core. As the core revolves, it presents slots of proper size to the hopper bottom, so drills are taken out individually. Counting is done by a sprocket having 12 teeth, so each completed revolution actuates the loader.

Hoppers, in each case, have one adjustable side to accommodate drill-length changes with size. The larger machine is directly adjustable for drills from ⅛ to ½ in. dia, but the barrel must be changed on the smaller for changes outside each series of three or four sizes. Counters are actuated by the passing of the drill itself, not on the conveyor or the index, so the count is certain.

New techniques Build '57 cars . . . II

Major changes, costing about $1 billion for tools and equipment, are largely responsible for new techniques and improved methods reported in the second of our series on the '57 models. Here are applications of ceramic tooling, combined welding and stamping, new superfinishing setups, internal cam grinding, gaging, ideas in drill design, and others

GEORGE H DE GROAT, associate editor

. . . at Chevrolet-Cleveland . . .

Ceramic tools applied to production work

Machines developed for special purposes include setups for grooving transmission output shafts in place of thread grinders, special equipment for producing internal grooves in over-running cams, a special machine that finishes the hubs of torque converter primary pump housings, and modified Fellows gear shapers that grind internal recessed cam surfaces. Other new developments include automatic loading and unloading devices at coining presses and improved shaft straightening machines.

Considerable study has been made of oxide tooling applications. Ceramics have been in limited use for machining SAE 1141 steel transmission output shafts and on standard gray CI transmission housings. Other jobs on which it has been tried include boring operations and turning the 13½-in. OD of a sheet metal converter housing. The housing was SAE 1010 and a solid oxide tool was run at 238 rpm (840 sfpm) with a feed of 0.015 ipr in a Bullard 8-spindle Continumatic.

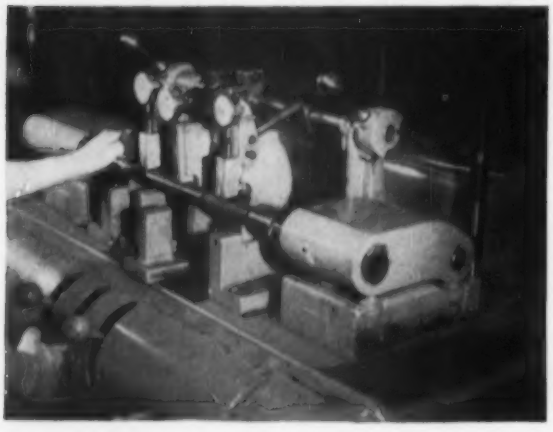
General conclusions, so far, are that all the precautions ordinarily taken with carbide tools are essential with ceramics, perhaps even more critical. Precise surfaces are required under the tool in the holder. Flatness is essential to eliminate bending stresses and tools must be rigidly supported without screws in contact with them.

Chevrolet has worked with various makes and grades of ceramic tools, using standard mechanical holders with carbide chip breakers. Experiments have been run on tool geometry, speeds, and feeds with varying results. One significant conclusion is that surface speeds with conventional equipment might be low for the best results with ceramics. In general, considerable care is required to prevent tool breakage; however, work finishes are good, often better than with carbide.

Handling ideas in coining and straightening . . .

Before . . . automatic loading and unloading equipment was installed in this coining press, an operator used tongs to locate forged propeller shaft trunnions in the die. Entire cycle was manual, including unloading. Considerable care was taken to locate forgings accurately on the die where they are straightened and coined to establish locating points for machining

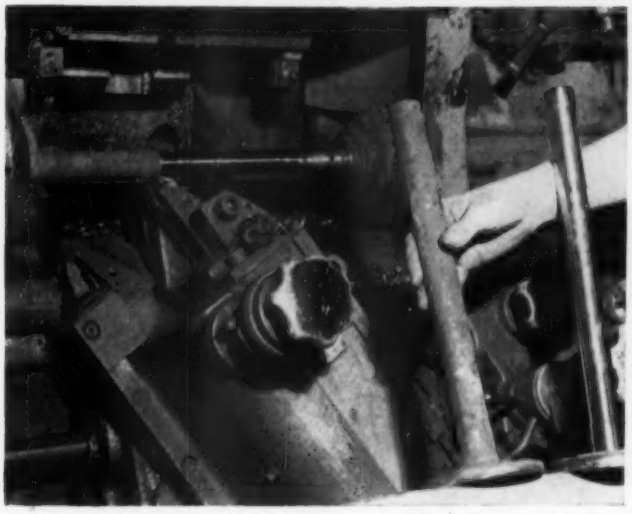
After . . . new equipment was installed, gross capacity was increased 150%. Press operates continuously while nests are loaded *outside* the die area. Fixtures index under the die on the upstroke of the ram and parts are automatically ejected into a chute in the rear. Hydraulically actuated shot pins position the fixtures within 0.001 in.



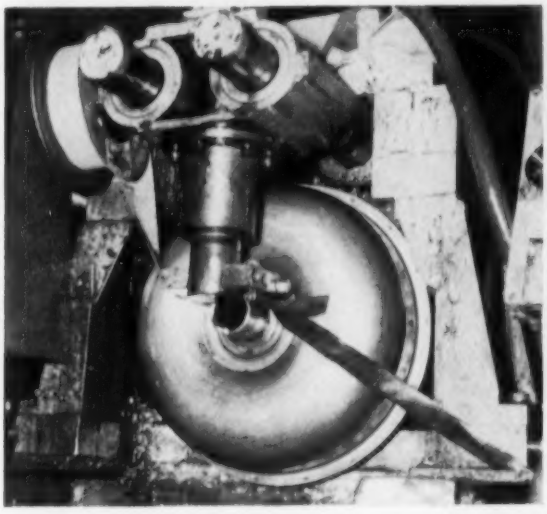
New straightening machine . . .
cuts time required with old hydraulic press 67%. Here, output shafts are straightened in an Impco machine with three special heads designed for the part. Three rams are independently operated; pulling lever down lowers a ram over a section of the part, turning a knob applies pressure. Operator's right hand controls the rams while the left is free to rotate the shaft under the gages. Horizontal movement and positioning of the part under the ram of a hydraulic press is eliminated, along with the need to reach from a control handle to the part each time pressure is applied or the part is indicated for straightness.

Indexing problems are eliminated . . .
with this Chevrolet-developed six-way shaper to machine drive slots in CI clutch drums. Previously the job was handled in milling machines where one operator at two setups produced about 25 pieces per hour. Spacing is held within 0.001 in., slot-to-slot; accumulative tolerance is 0.002 in. New machine holds this accuracy, but permits production of 90 pieces per hour with one man at two setups. Work is loaded on the center spindle and clamped with a draw bar. Spindle is hydraulically raised during the cut at 0.003 ips while shaper heads, operated by a bull gear and eccentric crank arms, run at 1200 sfpm. Nylon skirts at the shaper head slides keep chips out

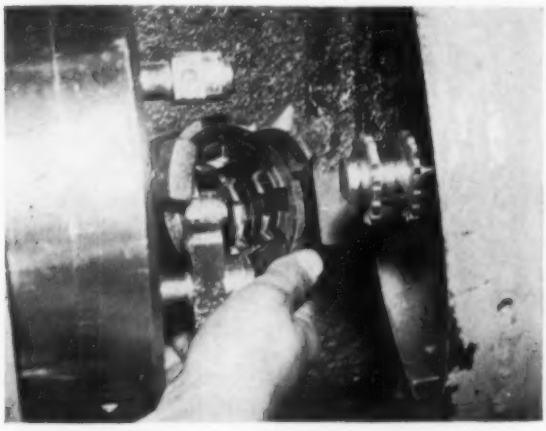
Ceramic tools turn shafts; Milling replaces boring...



Ceramic tools for contour turning . . .
C1141 forged output shafts (Bhn 220), in this New Britain machine remove about 7.37 cu in. of stock per piece. Average depth of cut is 0.110 in. with a feed of 0.010 ipr and a speed of 520 sfpm. Under these conditions, triangular insert tools produce about 50 shafts per cutting edge. Finish on the work is good. Tool geometry includes 5° primary clearance angle, 5° side relief angle, 5° negative side rake, and 5° negative back rake. Nose radius is 3/64 in., edge land is 15°, 0.003 in. wide. Work is run dry to avoid thermal shock at the tool



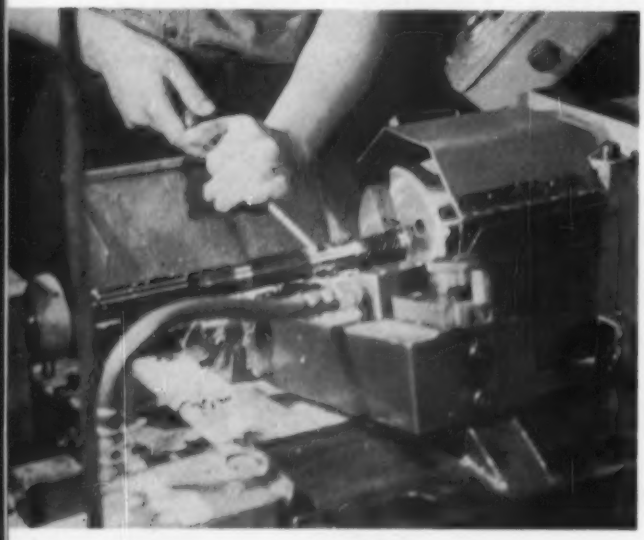
Surface finish . . .
on hubs of primary pump housings for torque converters is held to 15 mu in. rms with this special machine built by Chevrolet. Work is loaded into a rotating diaphragm chuck with the hub in contact with an abrasive belt fed from a reel and carried by guides in a reciprocating head. Reciprocation is considerably faster than that of commercially available equipment and a 2-sec dwell at the end of the cycle, while the hub continues rotating, produces radial finish lines that prevent leakage from seal in operation



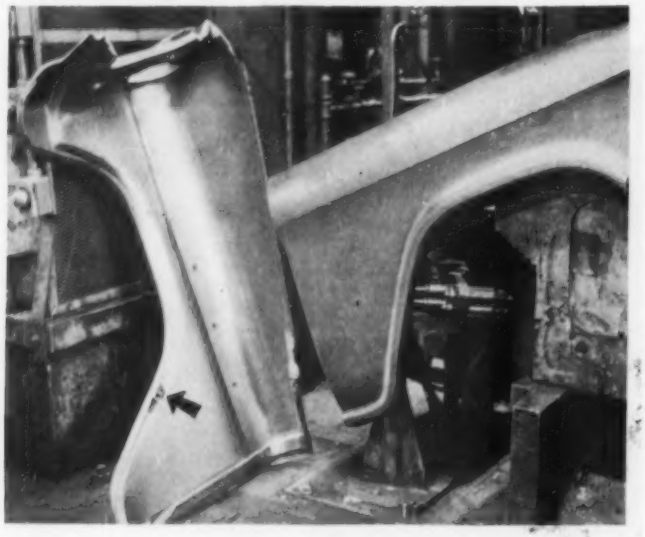
Milling cutters produce internal grooves . . .
in over-running cams in this modified Lees-Bradner automatic chucker. Operation follows broaching and is faster and simpler than boring. In addition interrupted cuts are far less damaging to the milling cutters than they are to boring tools. Production rates are higher and quality is improved

Internal cam grinding . . .
is accomplished in Fellows gear shapers modified at Chevrolet-Cleveland. Modifications include special hydraulic circuits operated by Power-Glide transmission pumps. Recessed internal cam surfaces are finished with a vertical grinding wheel in the reciprocating head. Work is held in a fixture, located by keys that engage external grooves while the eccentric table oscillates to produce the desired contour. Wheel head moves out of a recess at the end of one cycle for indexing to the next recess until eight contours are produced

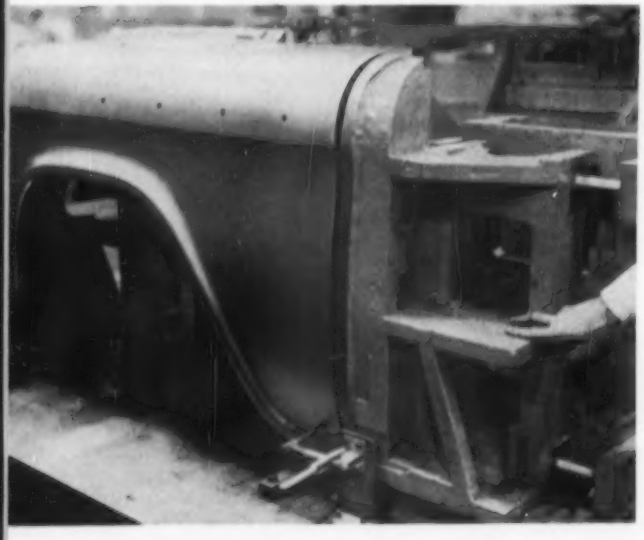
Combined operations save on shafts and fenders...



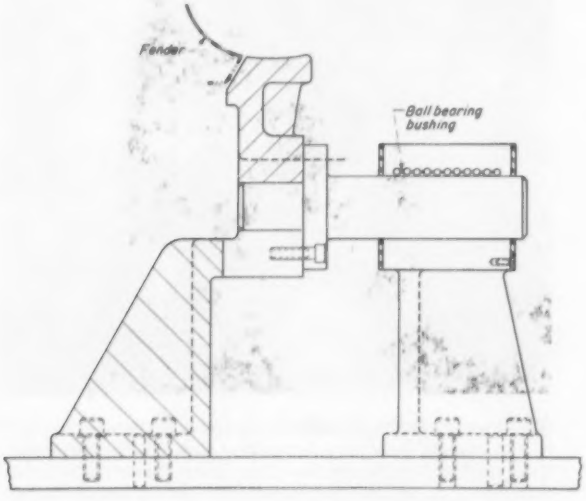
Production jumps nearly three times . . .
in machining grooves in transmission output shafts with this special machine. Four thread grinders were required before with burrs removed in a separate operation. Now burrs are filed off while grooves are cut with two single-point carbide tools located under the work. Tools are held in cartridges for easy replacement of both at once when sharpening is required. For maximum accuracy and rigidity pre-loaded bearings are used throughout the machine and the tool slide and bearing housings are bolted to a heavy CI plate. An Ex-Cell-O head drives the work



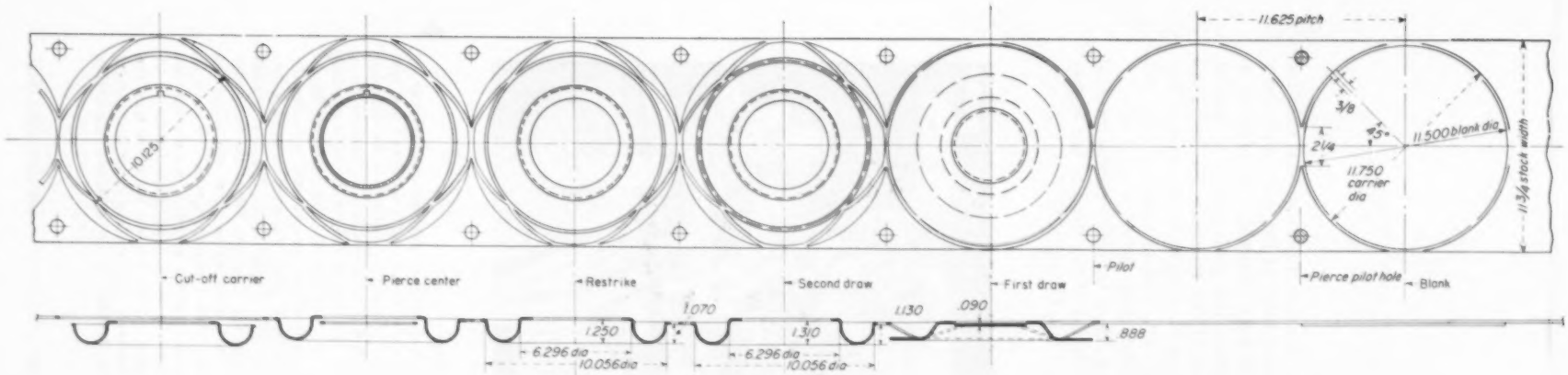
Stamping and welding are combined . . .
in 200-ton Danly press where front fender headlamp openings receive a flange and restrike operation. A stiffening bracket (arrow) is joined to the inside rear section of the fender by a Precision welding head timed to cycle automatically with the press. After the operator positions a bracket on a fixture at the welding head, the fender is located in the die and the cycle button is pressed. The operation eliminates handling that would be required with separate setups



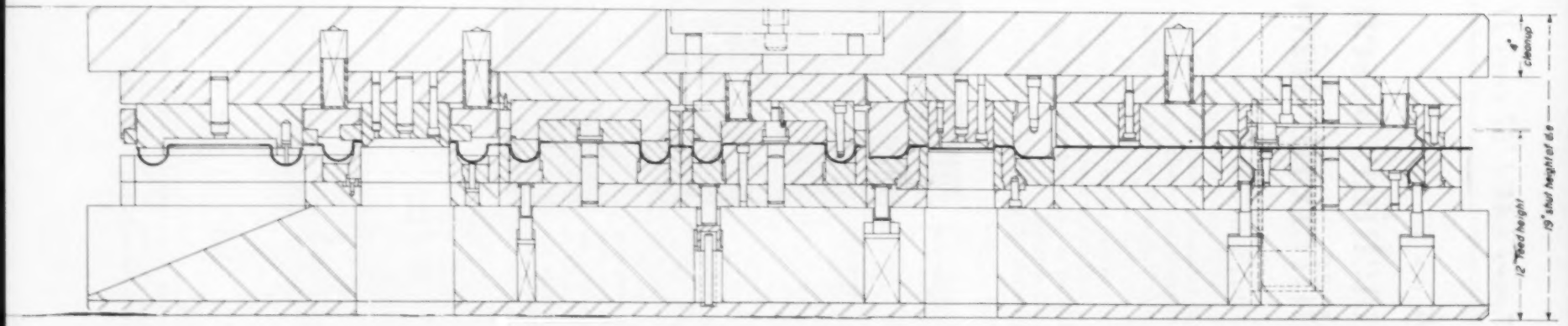
Finger-tip touch . . .
is all that's required to move a large sheetmetal contour-checking fixture. All retractable portions of the fixture, necessary for loading and unloading parts, move on Thompson ball bearings. Formerly, hinged or gibbed slides on these gages were not only inherently inaccurate but were difficult to move. Lighter plastic



gages were easy enough to move but do not have the accuracy obtained with the new design. Here, the door-line contour of a front fender is checked at one end of the gage, the parking and headlamp hole contours at the opposite end



Complicated stamping . . .
in this inner shell for a transmission converter pump. Material is AISI 1008 HRS, 0.0478-in. thick by 11¾-in. wide coil stock—replaces strip stock of the same thickness—but 13-in. wide and 104⅛-in. long previously required for stamping in individual dies. Hand fed strip was blanked, drawn and pierced in one toggle press—the resulting stamping then transferred to a second press for piercing the center and two locating holes. Now a progressive die handles all these operations in one setup—faster and with considerable savings in material costs



Progressive die . . .
for inner shells is run in a 300-ton Verson press at 20 strokes per min. At the first station two pilot holes are pierced and the work is partially blanked through to leave a carrier strip. Lanced relief suspends the blank on narrow ribbons and no distortion occurs in subsequent drawing stations. Progression is 11⅝-in. to second station, which is idle, and then to the third where the first draw occurs together with piercing a 4-in.-dia center hole. A second draw comes next, followed by a restrike, after which the center is opened to 5.377-in. dia. Carrier is cut off in the last station leaving a finished shell ready for piercing vane slots. All guide pins, heels, sliding and other wear surfaces in this die are equipped with Zerk lubrication fittings

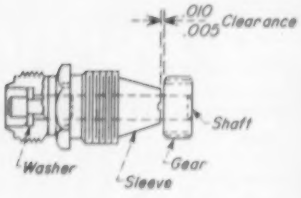
. . . at Buick . . .

One machine assembles eight different drives

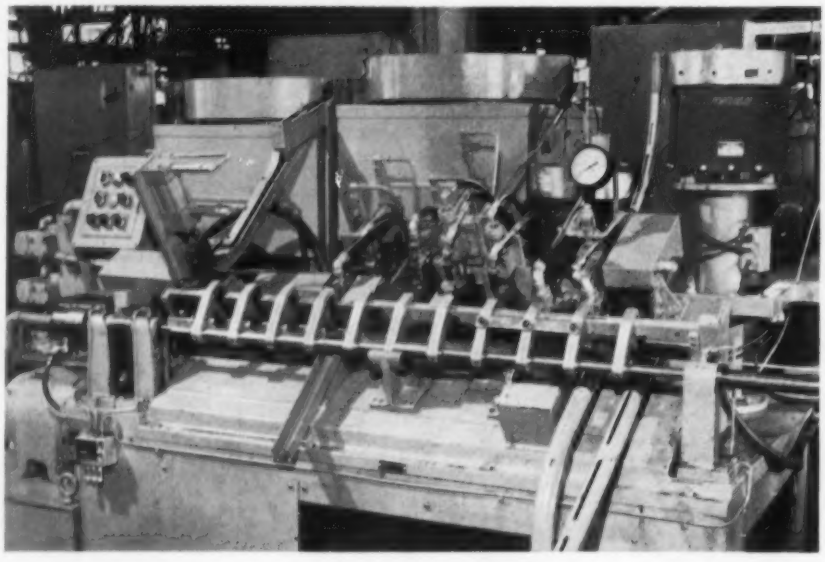
About 300 new machine tools for '57 car production have been installed at Buick. Outstanding among them is the latest in automatic assembly machines—a unit that puts together the components of eight different speedometer driveshaft assemblies. These assemblies go into the rear bearing retainer at the rear of the transmission case where the speedometer cable is joined to a shaft in the assembly. Eight different kinds are needed to suit speed ratios and tire sizes on different car models.

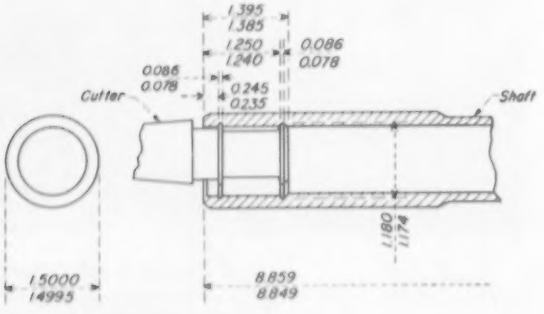
To insure installation of the proper driveshaft assembly in the transmission, the automatic machine stamps the numbers of teeth in the gear used—on a sleeve that goes into each assembly. In addition to the sleeve and a gear, the shaft and a C-washer make up the balance of the assembly. All parts are hopper fed to the machine, built by Interlakes Engineering Co in Detroit, and production rates are about five times faster than previous methods.

Other new tooling ideas include milling internal grooves instead of boring them. Results are higher production rates and longer tool life.



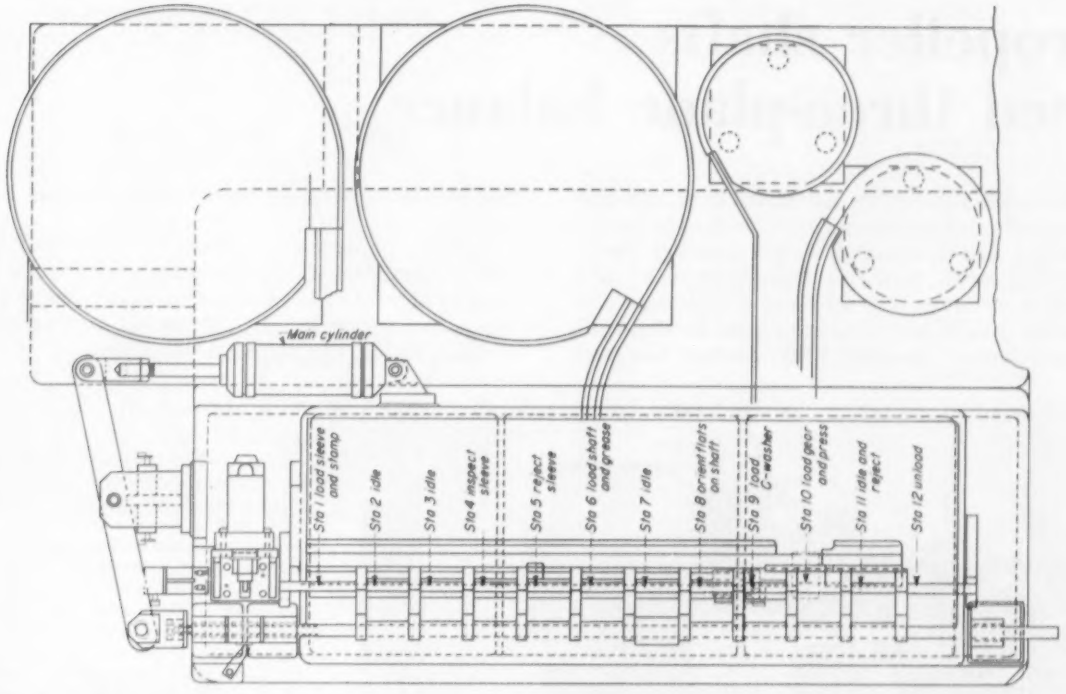
Automatic assembly . . .
of speedometer drive shaft components is handled in this machine at a rate of about 500 per hour. All parts (sleeve, shaft, washer, and a gear) are delivered to the assembly heads from Syntron vibratory hopper feeders. End clearance between the sleeve and the gear is critical, as is the fit of the gear on the shaft—a 0.0005 to 0.001 in. press fit



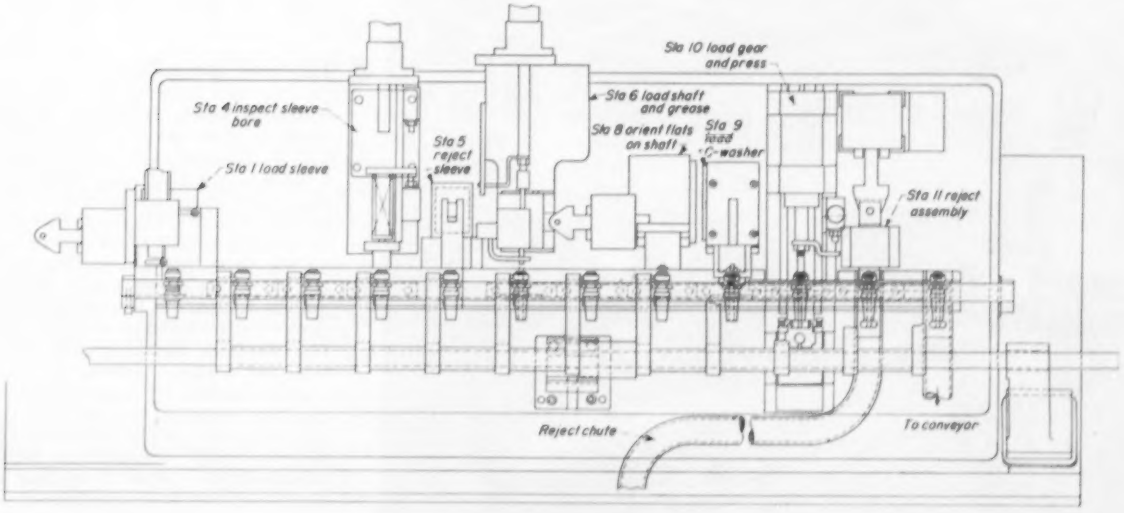


Internal grooves . . .
are produced with milling cutters instead of boring tools in machining shaft of tough alloy steel (R$_c$ 32 to 36). Solid cutter cuts two grooves, using a Hanson-Whitney thread miller

First assembly step . . .
is stamping number of gear teeth on the sleeve. A selector in the hopper-feed track orients sleeves to enter small end first and a solenoid-actuated plunger indexes the sleeve from the stamping unit to the load station. Next, the sleeve bore is checked for a hole tolerance of 0.001-in. and a gage plunger excites a solenoid at the following station to eject sleeves with undersize bores. Shafts are loaded next, oriented to present ends opposite the drive flats first. Before the shafts reach the assembly head, a limit switch operates grease jets to coat them. The next station orients the shaft to receive the C-washer. Gears are fed under the track to a stop where a slide moves them into alignment with the partial assembly, then a plunger pushes the shaft in the assembly into engagement with a gear box. An electric contact at this station checks the finished assembly for the fit of the gear and end clearance, excites a reject station to eject the part out of tolerance. Accepted parts enter a chute that directs them to a conveyor for delivery to an automatic packaging machine


Main cylinder
Sta 1 load sleeve and stamp
Sta 2 idle
Sta 3 idle
Sta 4 inspect sleeve
Sta 5 reject sleeve
Sta 6 load shaft and grease
Sta 7 idle
Sta 8 orient flats on shaft
Sta 9 load C-washer
Sta 10 load gear and press
Sta 11 idle and reject
Sta 12 unload

Ingenious linkages . . . actuate transfer mechanism in this speedometer-driveshaft assembly machine. Main hydraulic cylinder actuates the transfer bar for horizontal indexing and return with an adjustable stop at the piston to control indexing accuracy. With each index, rocker arms on the transfer bar slide parts along the feed track. A second cylinder, timed to cycle with the first, rotates the transfer bar radially through an angle of about 30° to remove rocker arms from feed track for return stroke


Sta 10 load gear and press
Sta 6 load shaft and grease
Sta 4 inspect sleeve bore
Sta 8 orient flats on shaft
Sta 9 load C-washer
Sta 5 reject sleeve
Sta 1 load sleeve
Sta 11 reject assembly
Reject chute
To conveyor

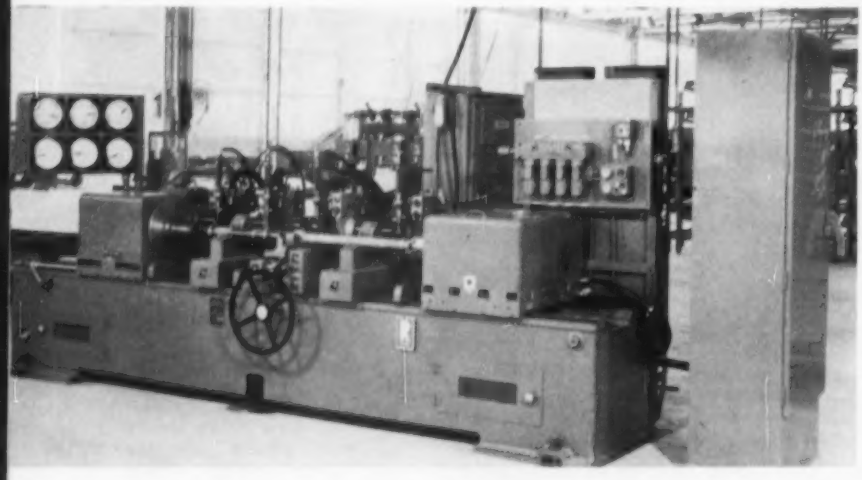
New techniques build '57 cars II . . .

. . . At Saginaw Steering Gear Div, GMC . . .

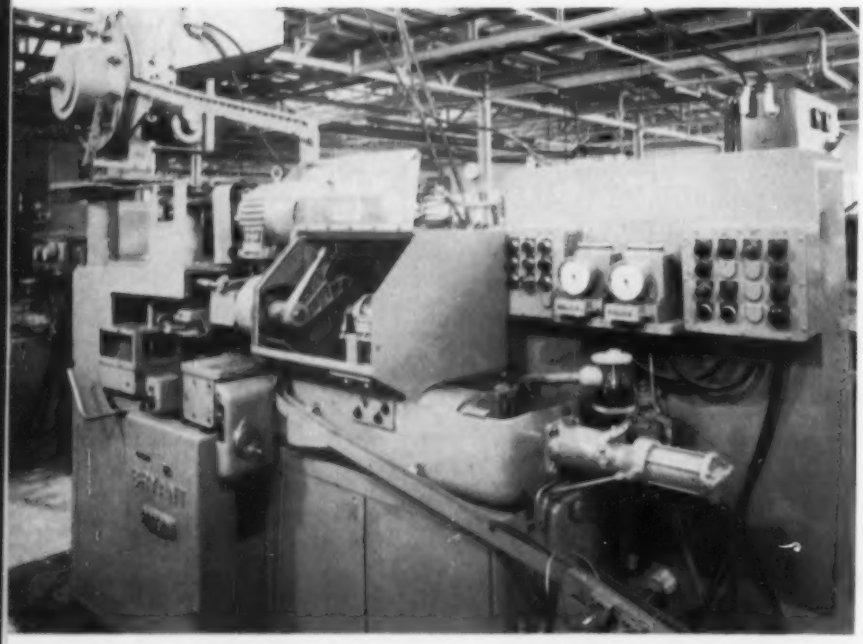
Propeller shafts need three-plane balance

Walking beam conveyors, automated lines, new machines and other equipment have been installed for producing newly designed 3-joint propeller shafts, and other parts. Balancing these new shafts is a precision operation and to insure a high degree of accuracy, special machines have been developed by General Motors' Research Staff. Another new part that requires special equipment for processing, is a universal joint bearing.

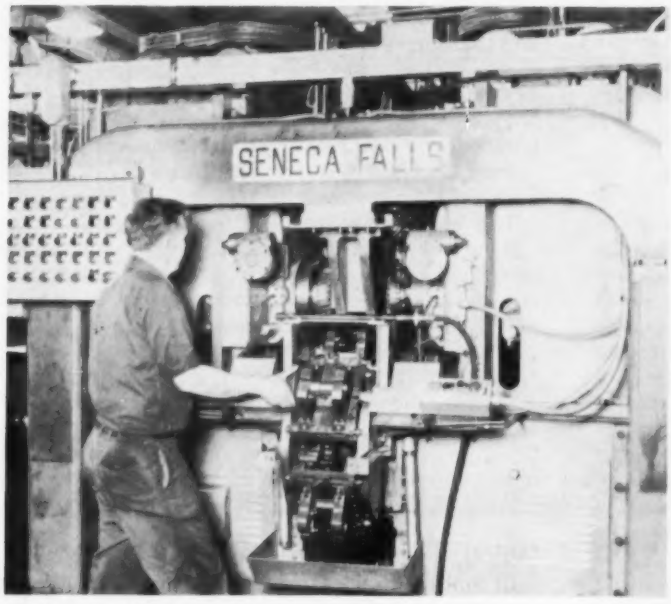
Special cam-operated internal grinders built by Bryant Chucking Grinder Co remove 0.015-in. stock from the bearing ID, holding concentricity with the OD within 0.0005-in. TIR. Automatic loading, unloading, gaging, and sorting are included.

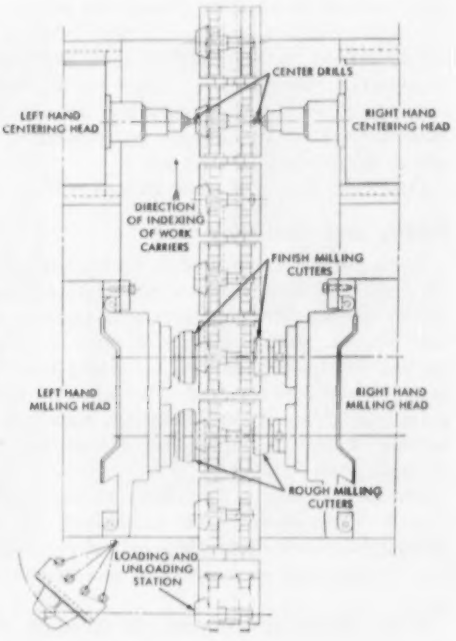


New driveshaft assemblies . . . employ two tube components with three universal joints, require a "three-plane" balance correction. This GM Research Staff machine handles both truck and passenger-car driveshaft assemblies and balances them dynamically within ½ oz-in. An auxiliary balancing head in the center of the machine bed records inherent unbalance in the center bearing assembly in the case of passenger-car shafts, or in the outboard bearing when a truck driveshaft is balanced. Usual balancing speed is between 2500 and 4000 rpm, depending upon the size and design of the assembly. Amount of unbalance and angular location are indicated on meters. A locking device retains the readings after the machine is stopped, avoiding need for an operator to remember amounts or angles. Welding heads join slugs to the driveshaft assemblies in three separate planes in weights and locations indicated on the meters



Internal grinding . . . universal joint bearings is a high-production operation in special Bryant machines. Parts are SAE 1118 HRS, with ID hardened to R_c 60 for a 0.030 to 0.040-in. depth of case. Production rate is 250 pieces per hr (100% eff) to remove 0.015-in. stock and hold the ID to 0.8534 to 0.8544 with a 15-20 mu in. rms finish and concentricity with the OD within 0.0005-in TIR. Wheel dressing is automatic, too, and feedback controls correct for wheel wear and part size. Electronic circuits provide minimum and maximum warning signals—initiate impulses for machine control, and light minimum and maximum reject signals. In addition to segregating in-tolerance and out-of-tolerance parts, a Sheffield gage controls the machine to shut down after a specific number of rejects are made





Milling and centering heads . . . are adjustable for depth of cut. Other heads can be added to the Model MX machine or substituted for existing heads to perform end milling, drilling, reaming, boring, threading or tapping on either end of the part

. . . *at Pontiac* . . .

"Extra" machines reduce downtime

RUPERT LE GRAND, senior associate editor

Pontiac's 1957 stem-pinion line, provided by Seneca Falls Machine Co, portrays several practical ideas on how to tool up for automated machining:

1.. The line consists of one double-end Model MX milling and centering machine and five Model AR 7 x 20 high-production turning lathes. It's possible to machine the stem-pinion forging with fewer lathes, as is done elsewhere, but there is a very good reason for using "extra" machines. Each lathe averages only 5 carbide bits, against a "normal" 12 on such work, but the line will produce at least 20% more work per shift than a more heavily tooled setup using fewer machines. Reason: downtime at any one machine for tool changes will not be enough to exhaust the parts banks between machines, and the time out per machine is less. Only one tool-change man is needed.

2.. Instead of an automatic device, Pontiac will use a man to load forgings so that the human element is present to detect pieces that would foul up the line, because of flash, oversize, etc.

3.. Gravity conveyors or inclined tracks transport forgings between machines and serve as parts banks. In a way, this arrangement agrees with GM's concept of segmented automation to avoid shutdowns of an entire line when an individual machine is down for tool changes, adjustments or minor repairs. Also, gravity conveyors don't cost anything to operate, except replacement of tracks when worn.

4.. Mechanical loaders are used at each lathe. Design of these loaders is such that they can readily be understood and serviced by the usual machine-repair man. If the device should need repair, manual loading can be provided until the loader is put back into service.

5.. Functions of the machines are mechanically timed to avoid intricate electronic circuitry. Again the average machine-repair man can handle adjustments and repairs once the line is installed and debugged.

6.. The facing and centering machine can be ap-

plied to shaft work if by chance the pinion might be made by another process in the future. And the lathes are of a basic design that likewise can be adapted to other jobs. In other words, Pontiac has secured a measure of security against complete obsolescence of equipment by reason of product design or processing changes.

Details of line will show how it works:

Facing and Centering

Stem pinions are milled to length (rough and finish cuts) and centered in a double-end Seneca Falls Model MX machine. In effect, this machine is built in two halves, each having its own double-spindle milling head and standard centering head complete with power sources and adjustments. Reinforcing members at front and back tie together the two halves of the machine and mount cylinders for clamping the fixtures.

The hydraulically indexed fixture conveyor is placed between the two halves of the machine. Motorized screw-type chip conveyors parallel the fixture conveyor on both sides and discharge to the rear.

Each double-spindle milling head is driven at constant speed by 10-hp motor and V-belt drive. The head is, of course, mounted on a vertical slide, so that the cutters can be traversed to the cut. If necessary, the heads can be spread apart for a job change and new fixtures provided. Adjustments are: coarse adjustment of the heads to the work by screw, working from the sides of the machine, and fine adjustment of the cutters by micrometer adjustment of the spindle quills.

The standard centering heads are each powered by a 3-hp motor. Additional motors supply hydraulic power for clamping and for indexing the fixture conveyor; pressure lubrication to all gear boxes, bearings and spindle bearings; and for chip conveying. The clamp slides and head slides are independently force lubricated. The coolant system is self-contained and flushes chips from the fixtures and fixture conveyor ways, and provides coolant for the center drill operations.

At the start of the cycle, the two fixtures opposite the milling cutters and the fixture at the centering station are clamped. Next the milling heads feed down to traverse the cut and reverse. Meanwhile, the centering heads advance and return. When the tools are out of the way, the fixtures are unclamped and the conveyor indexes 12 in. to the next station.

Production lathes

The five Model AR 7x20 high-production turning lathes are of the chip-flow bed design. If desired, the oil pan can be cut so that chips will fall into an underfloor conveyor.

The headstock spindle is fitted with both a center and carbide inserts that embed the head end of the stem pinion to prevent slippage. The tailstock is cam-actuated for positive timing with the automatic loader. When the tailstock has advanced its center to the work, the cam backs off slightly to allow for "growth" of the part and to avoid deflections.

A hydraulic cylinder built into the tailstock provides pressure to embed the carbide driver inserts. Then pressure is relieved to a predetermined point to avoid excessive tailstock bearing loads, but maintaining positive drive conditions.

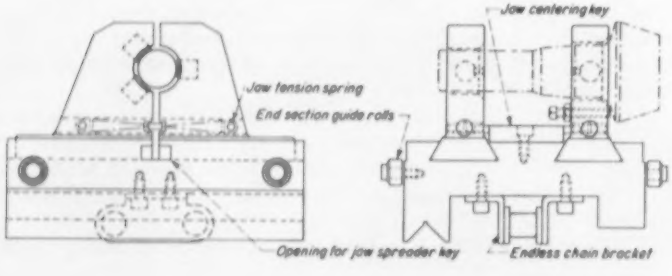
Improved mechanical loader

In contrast to the previous Model MTS loader, the new Model VHM loader supplied with the stem-pinion line is completely mechanical, which gives closer timing, reduces maintenance and has no traveling wires or air controls.

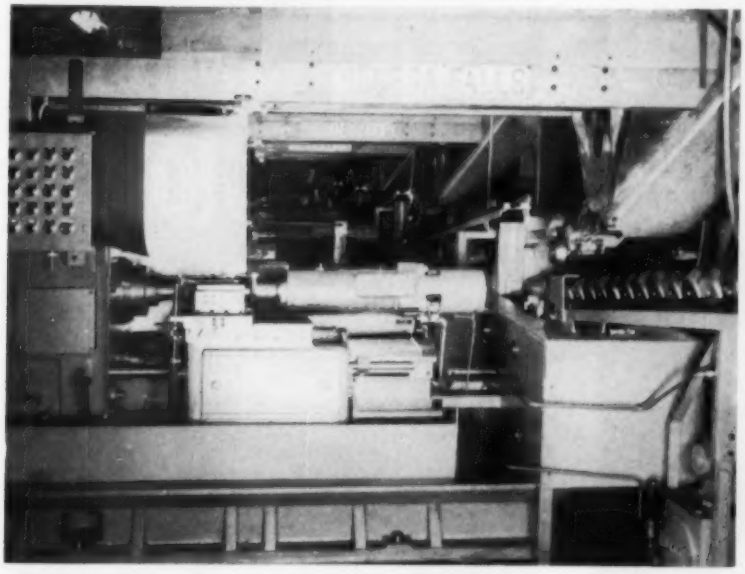
As supplied to Pontiac, the loader has a capacity of 1¾ in. dia max in the fingers and maximum work flange of 6¼ in. dia. In effect, this is the medium-size loader because it is likely that a larger model for 105 mm shell and a smaller size with a capacity of ¾ in. dia will be built.

Seneca Falls now offers the Model VHM loader to other machine tool builders for incorporation into automated setups of production lathes, grinders and milling machines, and is not confined to shaft-like parts. Seneca Falls prefers not to sell the device direct to users for installation on existing machines unless the machine is of the automatic-cycle type.

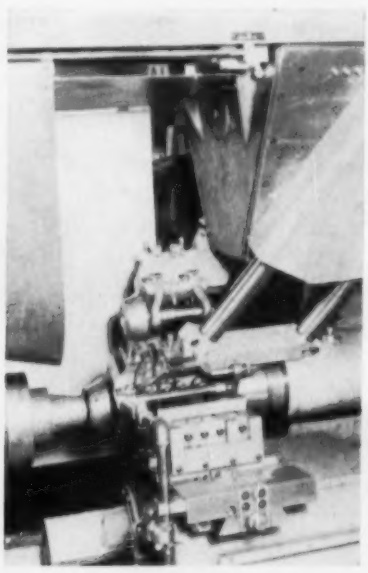
The loader is a U-shaped structure that runs lengthwise above the lathe. The right-hand end is beyond the conveyor; the left-hand pedestal can be either floor-mounted, or shortened to fasten on top of the headstock, as in the Pontiac installation. Drive



Vise jaws . . .
A V-shaped hydraulic clamping slide at machining stations compresses the gripping elements firmly around the workpiece. The slide also acts as a shot bolt to locate the indexed fixture



Left . . .
Model VHM loader carriage, over the conveyor, is holding a forging inserted in its fingers by the injector below. Lathe is the first of five Model AR 7x20 high-production turning lathes



Right . . .
Loader has moved into loading position, picked up the finished piece with its rear set of fingers, and is inserting a new piece between centers with the front set of fingers

and main controls are at the left. Power is supplied by a motor and gear reduction to a splined shaft that traverses the carriage over the lathe. Left and right travel of the carriage is obtained by engaging air clutches which motivate a sprocket through a double worm reduction gear. The carriage is attached to a chain through a block sliding in a vertical track in the carriage. This provides acceleration and deceleration to the carriage at the ends of the carriage travel. The carriage rides on hardened and ground wear strips, which are replaceable.

In effect, the loader duplicates the motions a man would make in placing a shaft between centers, except that a finished piece is unloaded and a new piece is loaded in the same cycle. The workpieces are gripped in two sets of fingers which can be changed to suit the job. When the part is placed in the fingers, two plungers are depressed, thereby closing the fingers, which are held closed by a mechanical latch. This latch is tripped mechanically to release the part.

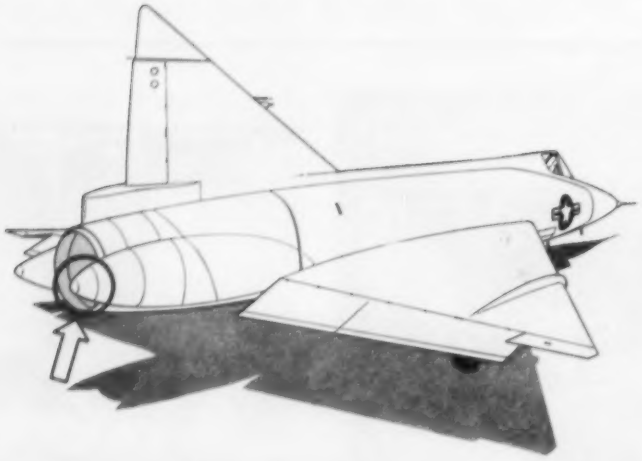
Here's the cycle: Assume that the loader with a workpiece in its loading fingers is waiting over the part being turned on the lathe. When the toolslides back out of the cut, a signal is sent to the loader's conrol. The proper clutch is engaged to cause the unload slide to move down and grasp the machined part. The centers retract, the unload slide lifts the machined part, the load slide lowers the unmachined part into the lathe, the centers engage the work and when the tailstock trips the finger latch the fingers open and the slide goes up. Immediately the carriage travels to the conveyor end, discharges the finished part, receives a rough part, and returns to a position over the part being turned, to start a new cycle.

Conveyor transfer station

Two pieces of equipment are located within the conveyor at each lathe. These are: (1) the injector that supplies a workpiece to the VHM loader and removes a finished part, and (2) the elevator that raises the finished part to the section of gravity conconveyor serving the next machine. Note: the injector is desired on the Pontiac stem-pinion line, but the VHM loader can be cycled at both ends of travel to eliminate the injector on some jobs.

This is how the injector works: Parts flow down the conveyor track to an escapement. When a part is to be loaded, one forging is released and it rolls onto the V-shaped ends of the two members forming the loading arm. With the loader's carriage and fingers in position above, the injector rises. The loading arm puts a forging into the load-side fingers and triggers a latch to lock the fingers. Meanwhile, the other injector arm unlocks the unload fingers and receives the finished piece. When the injector descends, the finished part rolls off onto the conveyor rack and to the roll-down slide.

At this position the finished forging is in position to be picked up by the elevator. A cam and camshaft tied into the feed train of the lathe trips a limit switch. Air is admitted to the cylinder serving the elevator, which rises, carrying the finished forging to the high point of the next section of gravity conveyor. It is released and rolls down the track to the next lathe.

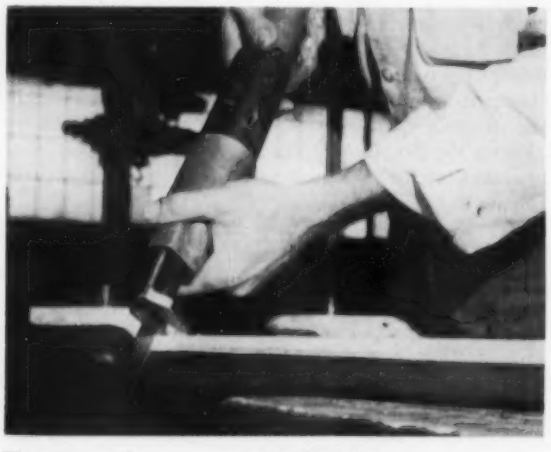


SHOP SHOTS

. . . AT CONVAIR'S SAN DIEGO PLANT

Tail fairings for F-102A supersonic interceptors . . .
smooth out air flow back next to the jet-engine tailpipe. (See top picture.) Old method of making them (left) was to rivet and spotweld (blind) 13 pieces together. New method takes only 4 pc (right), and saves 19,700 manhr, $35,800/yr. Contour is first spun on lathe, then drop-hammered to final shape

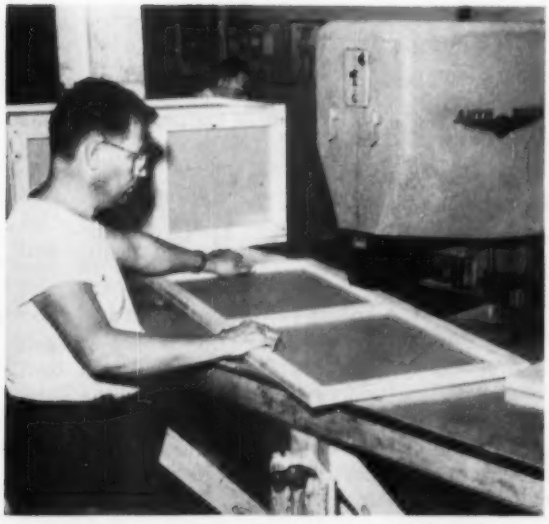
Portable office . . .
clamps on plane wing, rides along during assembly, and carries blueprints, reports, and records for that particular wing



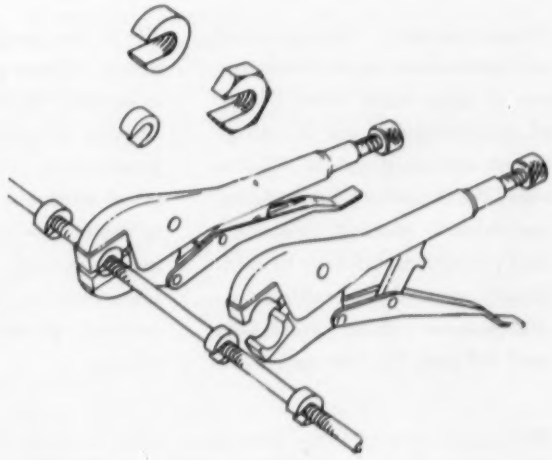
Pneumatic saw cuts plastics . . .
better and 12 times as fast as other saws. Plastic tools are trimmed around edges. One saw saves $10,000 annually

Corrugated metal table top . . .
lets chips fall below surface, preventing damage to soft aluminum when it's being sawed. Particles can be easily blown out after nut is finished

Old files weren't dull . . .
—just loaded with foreign matter. Instead of sending them out for sandblasting (@2¢/file) Convair now soaks them for 5-10 min in alkaline cleaner, cold-water rinses, dips them for 3 sec in 10% nitric-acid solution (if copper is present), rinses, and dips them in 50% muriatic acid for 4-5 min. Finally, they're rinsed and dipped in Oakite protective oil



Packing cases cost plenty . . .
but Convair saves $45,000/yr now by nailing up ⅛-in. composition-wood veneer with stout wrapping paper on each side. It weighs about half as much as ordinary packing-case ply veneer, and is only half as thick



Slip-squeeze nuts . . .
are new Convair patent. Slotted units can be slipped over long rods at any location; then nuts can be tightened with special-jaw vise-grip pliers. They eliminate tedious threading-on when models and templets are being made. Threaded ¼-in.-20 rod takes 5/16-20 nuts formed with ¼-in. slot, which squeezes to make perfect ¼-20 nut

Shell molding . . .
. . . is one of numerous metal-molding processes constantly being improved in pilot-plant operations. Here a green shell is about to enter the curing oven just behind the pattern plate. Typical of parts made by this process is the shredder ring illustrated.

Pilot plant proves production processes

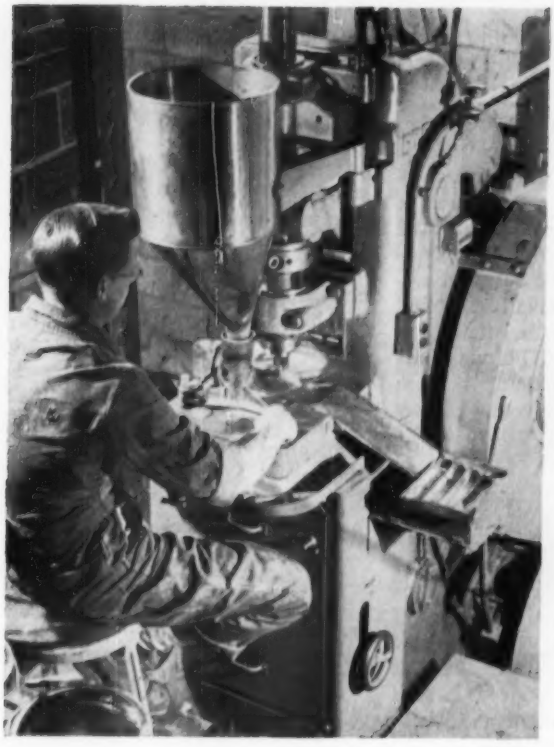
CARLYLE H WILSON, materials mfg dept, WESTINGHOUSE ELECTRIC CORP

Manufacturing development and pilot-plant operations are run in practically every phase of metallurgy at the Westinghouse metals plant in Blairsville, Pa. Activities range from specialized casting processes and powder metallurgy to cold-hearth arc melting, rolling special-purpose sheet materials, and forging high-temperature alloys for gas-turbine components. A large part of the plant is devoted to metal molding—ferrous powder metallurgy for production of sintered electrical contacts and high-density materials—precision investment casting, shell-mold casting, closely controlled sand casting, plaster casting, and others.

Although each of these processes has individual peculiarities and problems, there are similarities that make some degree of unification possible. These are: (1) each requires close control and engineering, (2) each has a number of variables that are best evaluated and controlled statistically, (3) they all produce a finished product requiring a minimum of finishing—or they are the only practical way to use certain materials, (4) each can replace machining difficult parts, (5) each process opens a wide variety of separate and distinct applications that must be investigated to remain competitive in manufacturing methods, (6) they all overlap in application to some degree and are, therefore, competitive, (7) development work in one process frequently takes advantage of experience in another and often allows use of the same equipment and facilities.

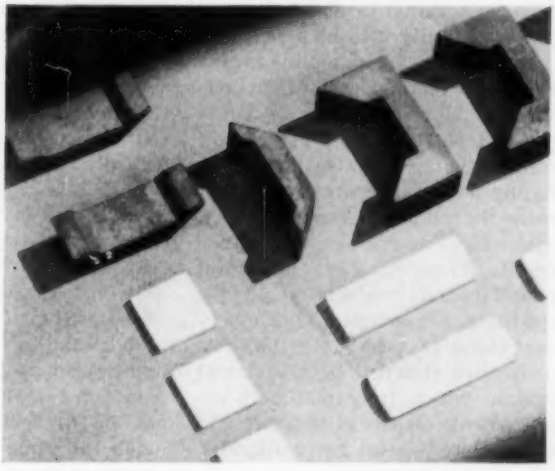
EQUIPMENT INTERCHANGED

Interchange and multiple use of facilities was an important consideration in setting up the various molding processes in one plant. For example, sintering furnaces are often used to heat treat castings, normalize magnetic parts, or for furnace brazing. Refractory mixes are sometimes pressed into special cores for investment castings in powdered-metal briquetting presses. In addition, reducing at-



Powder metallurgy . . .

. . . is employed for producing magnetic and other parts for manufacturing divisions. The 40-ton briquetting press shown is often applied to other metal-molding processes—just as sintering furnaces, mixers and other equipment are used interchangeably



mospheres normally used in processing powdered-metal parts have been employed for developing casting techniques such as mold elimination or for tests on metal cores. Blenders, mixers, and testing equipment are the same for preparing compositions of bonded sands or refractories and, of course, the same melting equipment is used for different casting techniques. Same heat-treating equipment and processes are applied for developing properties of alloys cast by different methods and, in many cases, this equipment is also used for sintering powdered metal compacts.

Special tooling peculiar to these processes requires similar toolroom techniques. Moreover, quality-control practice and equipment —Zyglo, Magnaglo, X-ray and dimensional inspection tools—are applied to all processes. Interchangeable heat-treat equipment covers a complete range of sizes and types, including small-tube furnaces, high-temperature furnaces and large car-bottom annealing furnaces. Facilities are available to utilize hydrogen, Ammogas, Exogas, Endogas, argon and helium atmospheres. Melting equipment includes indirect arc-casting furnaces, gas-fired melting furnaces for non-ferrous alloys, vacuum furnaces of 50, 300, 1000, and 2000-lb capacities as well as induction-melting equipment. Altogether, much of what is used in this integrated pilot plant would ordinarily be required in multiples if individual pilot setups were employed. Various processes under one roof not only support each other by the interchangeability of equipment—but, more important—this arrangement provides an excellent means of directly comparing and determining the best process for a particular part.

CASTING OR POWDERED METAL?

Often, small parts can be made by any or all of the molding methods. For example, part of a circuit-breaker assembly is a copper-base-alloy component and a silver-tungsten contact. Originally, the copper part was sand cast and required considerable machining, followed by furnace brazing the contact to a supporting shoulder. Result of investigating shell molding for the copper component has been to improve the physical properties by increasing soundness, improving surface finish and general appearance, and holding tolerances sufficiently close to eliminate all machining except drilling and tapping. The silver-tungsten contact is made economically by the powdered-metal process and it is expected that further cost cuts can be gained by additional developments in sintering, brazing, casting, and heat treating.

In another instance, both investment casting and powder metallurgy were considered for making an assembly consisting of a gear sector and a mounting bracket. Complete knowledge of both processes, showed investment casting, in this case, to be more practical than powder metallurgy. Production quantities were low—possibly 1000 assemblies—but more likely only 100 for prototype use. Of course, powder metallurgy could have been employed to make both parts, but tooling costs would be

difficult to amortize economically over such low-volume production. The two sets of tools for this process would have cost about $1600, and piece price—without tools—would run about $0.10 to $0.15 each, in addition to which the two parts would have to be assembled.

On the other hand, tooling for investment casting cost about one half the figure quoted for powder-metal tools and both parts were combined into a unit—thus eliminating assembly costs. Final costs were the same for both processes, assuming quantities remained small; however, other important considerations materially affected the choice of processes. One important factor was the higher physical properties obtained by investment casting which fully met part requirements, whereas the strength of powdered-metal parts, although adequate, was at the low limit unless special techniques were developed.

NEW DEVELOPMENTS

Processing specifications for each process are rigidly followed for most applications, however, it is frequently necessary to develop new techniques or modifications of existing methods to produce an unusual part. Casting problems arise where it is necessary to vary the shell or investment mix for an individual part. In one case, for example, an inorganically bonded shell mold was required for use in a vacuum furnace. This was limited to the one specific application but, having been developed, may well prove useful in future applications. It did draw attention to the use of a gas process for hardening molds and cores—and, with suitable additives, the process might provide a suitable shell or investment mold for extensive vacuum casting of reactive alloys. It might also provide the basis for development of a shell mold that can be fired and poured hot in much the same manner as investment molds are used now.

SPECIAL SERVICE

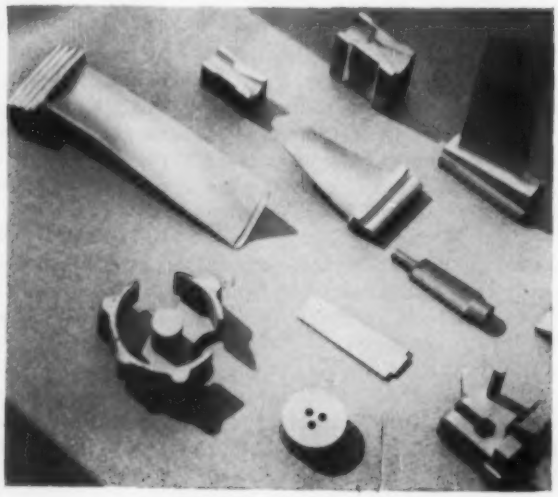
During the course of process development, the metal-molding section also produces saleable products. This development work is run on samples that are a regular product order from a manufacturing division. Samples are sold to such divisions as a special service, the return gained thereby reducing development costs.

The pilot plant also produces small quantities of special parts that may never reach large-volume requirements. Such products are not easily obtained from commercial suppliers because of the low volumes involved and the disproportionate amount of engineering time required. In some cases, parts are simple and could easily be machined but are processed at the pilot plant because wrought material is not commercially available or cannot be obtained economically. Another reason for making use of pilot-plant operations for company products is the high general quality obtained, as compared with commercial houses. Moreover, higher priority on tooling and production can be obtained from the pilot plant than could be expected from commercial suppliers because of the company relationship.

In addition to these special devices, the pilot plant constantly advances general processes so Westinghouse is in a position to evaluate new methods and make use of them at the earliest opportunity.

Precision investment casting . . .

. . . often competes with powder metallurgy and other processes. Choice depends on economics of the job, after comparing results with all metal-molding techniques



Round Table

Peaches and Cream

"What's going on around here, Al? I was just talking to Murphy, and he showed me a 'Happy Birthday' card he got from the personnel department."

"Well, it's about time the company showed the employees it thinks more of them than just as clock numbers. I'm glad to hear it."

"Wait 'til I tell you what else Murphy pulled. He claims the company should remember that he hasn't had a raise in over a year, if it can remember his birthday; and he hit me for a boost in pay. How's that for sweetness and light?"

"So what, Ed? You've had demands for raises based on flimsier reasons than that. Even so, I think the card was a good idea. I hope they keep it up."

"Swell; and now we can expect a regular parade of cards—and complaints about pay."

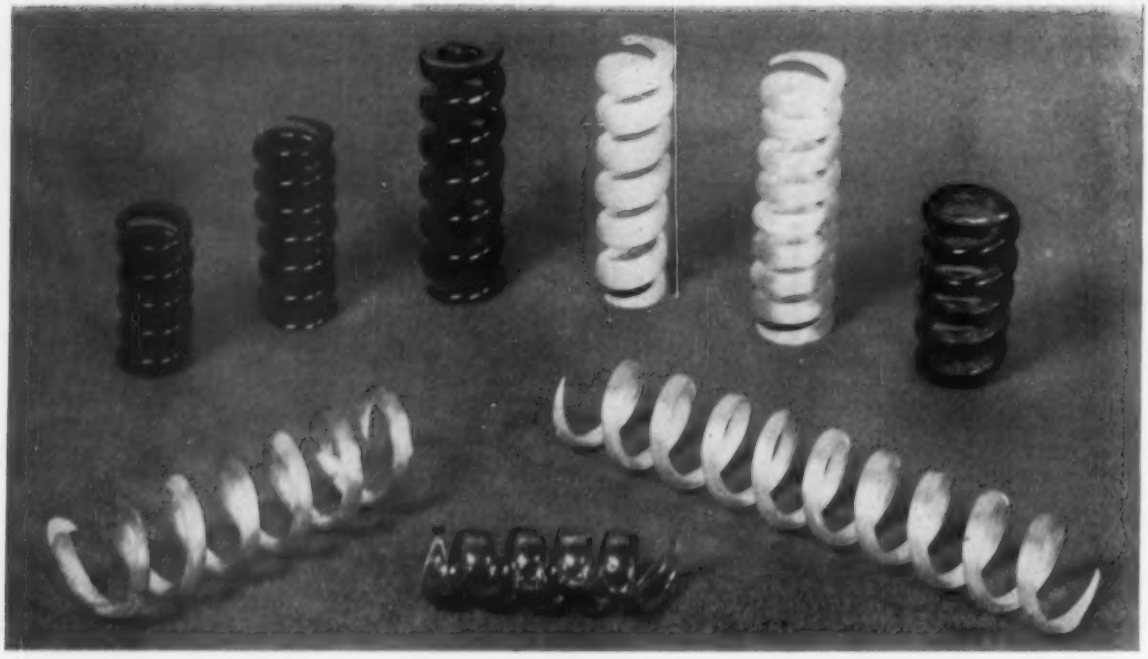
"Don't always expect the worst, Ed. I've heard of a company that even sends out flowers to employees' wives and women employees on their birthdays. It's just a touch that pays off in good will."

"Are we supposed to be making everyone feel good, or are we supposed to be making money? This isn't a rest home, Al. We're supposed to be in business."

"Sure, Ed; but a little consideration and thoughtfulness go a long way; especially if it's a company that's supposed to be hard-boiled that's showing the consideration. Maybe the men will ridicule the idea, but I'll bet they'll be secretly pleased."

"I'll be publicly pleased if they'd save their money and maybe use it for guys like Murphy who should get raises instead of glad-handling."

***SHOULD** a company get into the social swim or is it out of bounds for industry? Would it help morale in the plant? Your ideas may help others. Discussions of earlier topics start on page 214.*



How to make plastic springs

Springs formed from glass fiber-reinforced resin have many desirable mechanical and decorative properties for a wide range of applications. Until a practical technique for mass-producing these springs was developed by the National Bureau of Standards in work sponsored by the Army Ordnance Corps, there was no satisfactory way of making them. Here is the recommended procedure

Polymeric materials, such as plastics and rubbers, have a number of inherent advantages for use in springs for special purposes. For example, they are non-magnetic and have low electrical and thermal conductivity. They can be molded directly to dimensions without the formation of appreciable internal stress. Their high corrosion resistance should make them valuable for applications in chemical plants and installations subject to either acid fumes or salt air.

Of particular interest is their possible use in plating rooms, as separators, retainers, and shock absorbers. Other applications may benefit from the strength-to-weight ratio of plastics, which often is higher than that found in spring-making metals. Also, the broad selection of transparent and colored materials can be used to provide striking decorative effects.

Plastic springs are molded by drawing resin-soaked glass fibers through vinyl copolymer tubing and wrapping the loaded tubing in a helix around a mandrel. After curing in an air-circulating oven, the tubing is removed, leaving a solid plastic spring reinforced with glass fibers.

The most successful method uses vinyl chloride-vinyl acetate copolymer tubing having a ¼- or 3/16-in. inside diameter and a ⅛-in. wall thickness. Lengths of glass rovings are formed into a loose yarn, without twist, which then is doubled back to make a U-shaped bundle. This bundle is placed in a trough which is partly filled with liquid resin and is immersed until thoroughly soaked. A steel wire is threaded through the tubing and attached to the U-shaped bundle at the end. It is used to pull the bundle through the tubing. Considerable force is applied to the wire by a small windlass.

When the tubing is completely filled, the wire is disconnected and the tube ends are sealed with hose

1 . . Plastic-spring material is started by soaking a "rope" of glass fibers in a resin solution. Choice of resin and quantity of glass fibers is determined by ultimate use of spring. Rope is doubled into a U shape

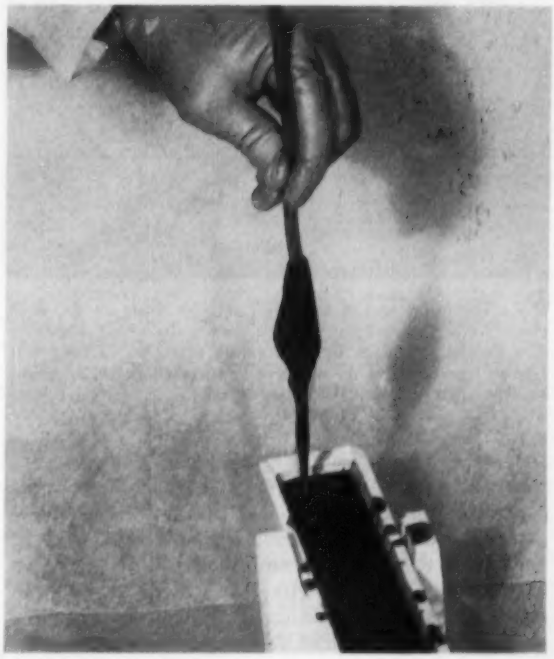
2 . . Length of piano wire is tied to one end of glass-fiber rope, at the U-bend. Operator wears rubber gloves to prevent contamination of glass and protect hands against resin. Resin-soaked glass-fiber rope is drawn into and through the plastic tube, using a small hand-turned windlass

clamps. Then the tubing is wound on a mandrel and the entire assembly is placed in an oven for curing under the conditions specified by the resin manufacturer. After removal of the tubing, post curing is performed as required, and the springs are cut and ground to their finished length.

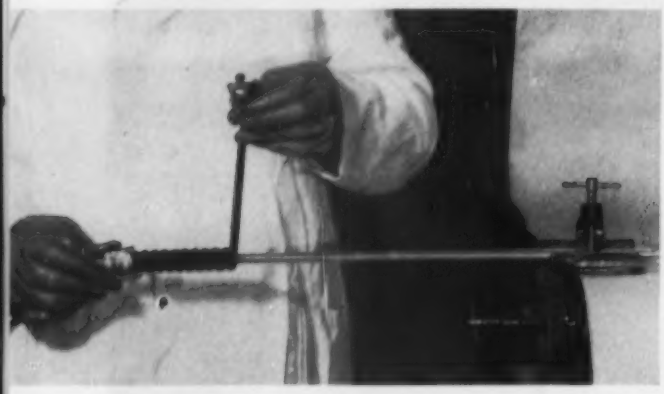
Of the resins studied, the most promising were epoxides and polyesters. These resins are better suited for spring applications on the basis of torsional moduli, temperature sensitivity, and ease of handling. In general, the polyesters are more sensitive to elevated temperatures than are the epoxy resins, but the epoxy materials vary widely in this respect.

Springs made from polyester resins with glass-fiber reinforcement show good energy recovery properties after short periods of storage at –40 F, but these properties were adversely affected by 13 days exposure to 135 F while under stress. The best results were obtained with an epoxy resin cured with **m**-phenylenediamine. Springs made of this material had torsional moduli of rigidity of the order of 1.0×10^6 psi. In 2-in. lengths they deflected ½ in. under a static load of 25 lb. Springs 3 in. long of this type retained 40% of their original energy when compressed to their solid length and stored at 135 F for 13 days.

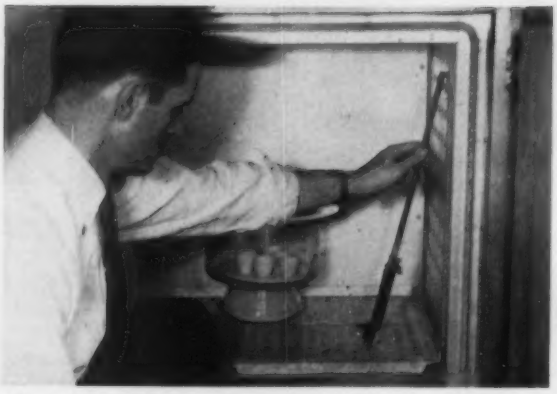
When the glass-epoxy springs were tested for re-



3 . . Excess resin solution is squeezed out of the tube by running the fingers, in a pinching action, down the tube



4 . . Tubing is wound around a mandrel, turned to the required ID of the spring, to form a helix. One end of tube is clamped to mandrel to start and then the other end is clamped after winding is complete. Just a firm pull is necessary during winding. Shaped mandrels can be used for odd forms, and winding two tubes simultaneously will provide open helix



5 . . For curing, wound tubing, still clamped to mandrel, is placed vertically in an air-circulating oven. Temperature is determined by specifications for resin being used. After curing, spring is stripped from mandrel; then cleaned, trimmed, and ground to size ready for use. Aging may be used before use to improve certain properties

6 . . Torsional test of a plastic specimen made by the same procedure as the spring material is used to determine suitability of a number of resins for spring use. Stress by twisting was applied by weights in the metal can suspended from the pulley, and the angle of twist under load is read on the circular scale

7 . . Creep test of spring under load. Deflection is measured on dial indicator while applied load is read from dial in operator's hand. Aging under load can improve properties of some resins

coverable energy a second time, higher values were invariably obtained. This characteristic "work tempering" of the epoxide resins was also demonstrated in torsion tests on nonreinforced plastic rods. An improvement of as much as 120% over the original available energy was indicated. This property of the material can be utilized by preloading the epoxide spring during storage or within 30 days before use.

Mechanical and thermal properties of the plastic springs can be varied widely by proper choice of materials and dimensions. For example, stiffer and more brittle springs result when the glass content is increased. At the same time, a high degree of homogeneity in static properties can be achieved. Under a load of 25 lb, 100 of the epoxy-resin springs had an average deflection of 0.53 in. with a standard deviation of 0.05 in.

For further details on plastic springs, see PRODUCT ENGINEERING, June '56.

The future of industrial engineering

"To know where you are going, look over your shoulder at where you have been!" This advice never was more applicable than to the Industrial Engineer and the people responsible for this phase of Management. Here are some ideas for the future, and a review of the past, from the new *Industrial Engineering Handbook* (see Book Review, p 240) edited by Harold B Maynard and published by McGraw-Hill Book Company, Inc

It is a half-century of industrial progress since F W Taylor's pioneer work was first made known to the American Society of Mechanical Engineers in his now famous paper, *Shop Management*. This work, in 1903, was directed at three different levels of the management problem in which different degrees of accuracy are possible:

1. The actual processes performed by individual workers. Here, as H R Towne commented on Taylor's presidential address to the ASME, "On the Art of Cutting Metals," he had taken an art "coeval with the passing of the stone age" and which had remained almost unchanged from the beginning until nearly the present time and had "lifted it," in a single lifetime, "from the plane of empiricism and tradition to the high level of modern science and apparently had gone far to reduce it almost to an exact science."

2. When the "one best way" of doing any particular process has been established, there remains a complex of problems of organization, planning, supply, costing, and so on—if the worker is to be assured of the constant conditions which will enable him to secure consistently the level of productivity and remuneration determined by the scientific approach to process planning. Taylor did not imagine for one moment that these problems were susceptible to a scientific solution in the same sense as a problem in engineering.

He was well aware that he was dealing with human nature. He did believe it was possible to collate experience bearing on them, to establish principles, to set up standards of performance, and to substitute this body of professional knowledge for the reliance on custom, use, and wont and individual experience which was general in his day. "Management," he wrote, "is destined to become more of an art." This group of problems is concerned with the mechanics of management.

The engineer is not always the best manager but the manager with a knowledge of engineering discipline usually is a better manager.

3. There still remain the problems concerned with the will of any group of workers to collaborate wholeheartedly in the undertaking in which they work—the issue which is described as *morale*. At this level, Taylor did little research. He laid down, as the first condition "without which scientific management cannot be said to exist in any establishment" that "both sides take their eyes off the *division* of the surplus as the all-important matter and *together* turn their attention to increasing the *size* of the surplus."

He also wrote, "there is another type of scientific investigation which should receive special attention, namely the accurate study of the motives which influence men." But these problems in the dynamics of management call for disciplines such as anthropology, sociology, psychology, and the like in which Taylor, as an engineer, was not instructed. And the most important of these disciplines, psychology, is the youngest of the inductive sciences. It is likely to be many centuries, if ever, before it obtains the standards of accuracy possible in the physical sciences.

Since the beginning of the century, industrial engineers have gone far to develop the work started by Taylor at the first level of management so that it is readily applicable not only to the cutting of metals but to every operation performed by the individual worker in business life—and even to simplifying household chores. They have made great progress with problems at the second level. Between the two they have raised productivity not only in the United States but all over the world and thus have done much to improve the standard of life of all peoples.

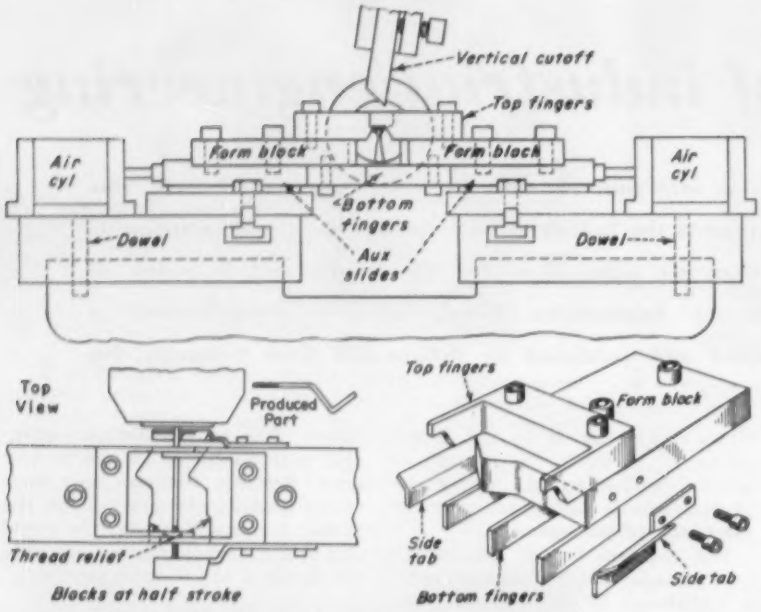
Problems for tomorrow

At the third level, many problems are still unsolved. Also, industrial engineers have encountered much opposition and criticism, especially from representatives of the workers. This has been healthy, even where the criticism has been emotional and ill-founded. It has forced the industrial engineers to reexamine their techniques and to perfect their methods. International contacts have compelled them to clarify their thinking and to try to standardize their terminology.

There are still many difficult and recalcitrant issues ahead. They will be solved more quickly and more easily if the engineering profession will recognize generously that science—more exact knowledge—is the private bailiwick of no individual and of no group of men. It is the social heritage of humanity. A business is a society, and to its effective management (government), many disciplines must contribute. Some of them are much less developed than the physical sciences underlying engineering. Engineering enjoys the immense advantage of long practical experience in industry.

Industrial engineers should use those advantages, not to build an empire or to establish frontiers, but to ease the work of integrating these newer disciplines into business practice. Thus can they contribute to the huge task of making the epithet "scientific" more completely applicable at all levels of management.

Practical Ideas . . .



Bending Operation Performed On Automatic Screw Machine

Second operations are rare in the work handled by automatic screw machines, at least where standard machine operations are concerned. But where bending of parts, such as the sample shown, is required, it is usually done in two operations on wire forming, spring making, or four-slide machines; with the threading done as a second operation.

While few engineers will be interested in the part itself, the tooling is new and different. It could open new possibilities in the screw-machine field.

The parts come from the machine complete, threaded, cut to length, and formed. It's a hook of 0.062-in. phosphor bronze wire with a #0-80 thread.

In producing a part of this kind, the thread is made first by any convenient method, a solid die, a self-opening die head, or a thread-rolling head. It is then cut off, dropping on the fingers situated at the bottom edge of the form blocks, at half stroke position. The forming is completed with blocks at full-stroke position, after which the slides open, dropping the finished part into a trough or chute.

In preparation for this setup the cams designed to drive the slides are removed, whereupon the slides are pinned directly to the machine frame. The pins used must be of adequate proportions, since they will carry the press load, placed in positions where they may be removed when slides are to be active in another setup.

Small purchased auxiliary slides are bolted to the machine slides with air cylinders to operate them. The air cylinders are actuated by a pilot-operated valve, controlled by trips on the cam shaft.

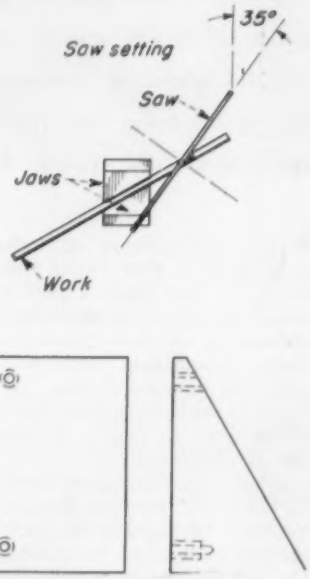
Each auxiliary slide carries a form block, and each is equipped with two sets of fingers. These fingers interlock at half-stroke position. The top fingers restrain the part during cut-off and force it to drop straight down when severed.

As part drops down on the lower fingers, it is positioned by the side tabs, properly locating it for the press stroke. Air cylinders, valves and air lines are of generous size to provide adequate press force.

Upon completion of form stroke, cylinders snap to full "out" position, permitting part to fall clear, allowing threading die to come in, starting a new operational cycle.

We had no problem with this part dropping free, but it may be necessary in some cases to eject with air or by springs.

Buckley Sullivan, Cleveland, Ohio



Auxiliary Jaws Increase Angular Cutting Range

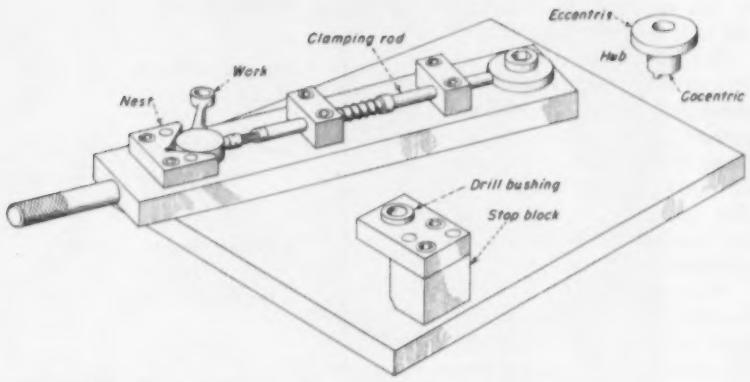
Most abrasive cutoff machine heads, for the angular cutting of flats, rounds, and tubing, are usually limited to a maximum setting of 45° (with respect to the longitudinal axis of the stock).

To increase this range, a pair of removable jaws can usually be made to fit the machine's vise or clamping arrangement. The jaws, made of case hardened steel, are designed to pre-position the stock at a 30° angle. Thus, with the use of the jaws, the angular cutting range of the machine will be increased to 75°. The saw is set to the difference between 30° and the required angle of the cut.

A typical jaw is shown in the illustration; sizes and mounting holes will vary with existing conditions. Shown, too, is an example for a cut of 65°.

When not in use, provision should be made for the safe storage of the jaws at the machine.

Clement F Brown, Willow Grove, Penna



Swinging-Arm Jig Works Fast

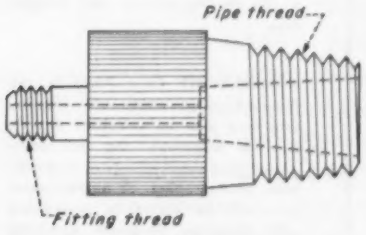
Small parts are often awkward to hold in drilling operations. We devised the "swinging-arm" fixture shown, primarily because of the simplicity of holding the parts. We were further rewarded in that it is fast working, cutting cost of operation greatly.

The whole cycle of operations consists merely of nesting part between V-stop and clamping rod, swinging the arm counter-clockwise 'til it hits stop-block, clamping the part as it positions it under the drill-bushing. After drilling, the arm is swung open, releasing the part, and the jig is ready for the next cycle.

The component parts are: A baseplate, a bushing-carrying stop, and a "swinging-arm." The arm swings on a hub, keyed and bolted to the plate with an eccentrically machined head acting as a cam and retainer. An adjustable-length clamping rod rides in two blocks attached to the arm. A light spring holds the rod against the cam, allowing loading and unloading of work without any interference from it.

The cam should be so located that the clamping rod will be riding on its highest point when in closed position.

Clifford Molloy, Bronx, NY



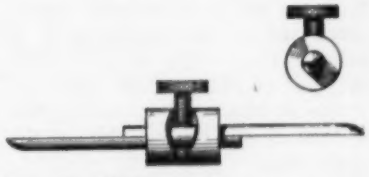
Plastic Fittings Speed Testing

Testing and calibrating pneumatic instruments is part of the work in our shop. We have found that a lot of time and expense can be saved by using adapter fittings made of Teflon or other plastic material.

The resiliency of plastic takes up into small thread imperfections where "dope" would be necessary to make an ordinary fitting tight. The major advantage of this type of fitting is found in the fact that no wrenches are used; hand-tightening is all that is necessary.

We have a good selection of these fittings on hand, with every thinkable pipe thread included. Thus we can quickly connect to the signal port of any instrument to be calibrated.

Harvey Muller, Danboro, Penna



Length Of Pin-Gage Is Adjustable

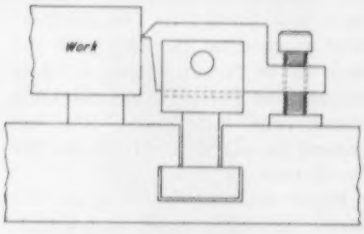
We depend a great deal on pin gages in our shop, because of the small bores we handle. The gage illustrated has saved us a lot of time in that it has eliminated the need for manufacturing a new gage for each new diameter.

As is customary with a solid pin gage when small changes have to be made, it must either be filed down to shorten it, or peened to stretch or lengthen it. When an existing solid gage is beyond the scope of adjusting to another size, a new gage must be made.

An adjustable gage makes changing from one size to another relatively simple. Loosening of the clampscrew to release the rods allows setting the gage to a selected measurement of the micrometer.

The rods for a small gage are cut from a suitable cotter pin. Larger gages can be made from rods manufactured to simulate large cotter pin stock. The clamping arrangement consists of a snug-fitting collar and clampscrew. The points should be suitably rounded and case-hardened.

Robert Wilson, Renfrewshire, Scotland



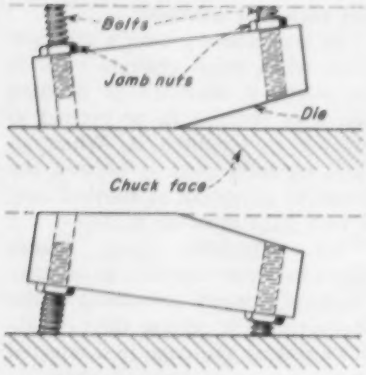
Hold-Down Clamp Leaves Working Surface Clear

These hold-down clamps are desirable when it becomes necessary to take a cut over the entire top surface in milling or planing operations. With ordinary straps or camps this is impossible, for they get in the way as the cut progresses and must be moved.

A hold-down clamp consists of a block turned in one end to fit the T-slot of your machine. The other end is slotted to take the hardened jaw, pivoting on a substantial dowel pin. The back end of the jaw is tapped for a hollow-head capscrew which supplies the clamping force.

A pad may be fitted to the screw, or a piece of flat stock can be slipped under the screw to prevent marring of the table.

Clint McLaughlin, Rockaway, NY



Bolts Provide Legs For Die Grinding

When a blanking die has plain or compound shear on its cutting edge, it can be quite a problem to grind without a lot of time-consuming indicating.

Bolts can be made to serve as legs to stand the die block on at the proper angle. Insert four bolts in the holes provided for fastening the block to the die shoe and lock them with jamb nuts. Cut them, as near as possible, parallel with the face to be ground. Die is then placed face down on the magnetic chuck, and all four bolts are ground to equal height from the chuck face.

Place the finished legs on the chuck, blocking them with parallels to prevent die from being thrown off.

Repeat operation for each face of the die, if it's a compound shear die, until die has been completely ground

R J Hartmeister, Golden, Colorado

Stripper Bolt Tapping Hint

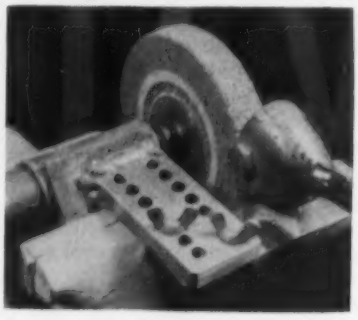
Holes tapped perpendicular to the work face are always desirable but not always accomplished. In the case of stripper bolt holes, this is a must, for if holes are inaccurately tapped binding will result. I have found the following method useful:

A stripper bolt is modified to serve as tap holder and guide. The threaded portion is first cut off. Then a hole is drilled into the exact center of the bolt, the size to be the same as the diameter of the tap shank. A smaller hole is drilled deeper to allow the square portion of the shank to broach itself into the bolt to form a socket.

To prepare for tapping, and before drilling, the stripper plate and mounting plate are clamped together with parallels between them. Holes are drilled in the proper locations using the tap-size drill. The holes in the mounting plate are opened up to the size of the stripper bolt body.

With both plates still clamped together, the modified stripper bolt and tap are inserted through the mounting plate. All the holes are tapped in this manner, using a regular hexagonal key to turn the tap.

W R Konle, Granada Hills, Calif



Wheel Dresser Support For Portable Grinders

Difficulty in dressing the wheel on flexible shaft, or portable grinders, has at some time or other been experienced by men who use them. We found this to be true in our shop, and as a result, this is what we have done about it:

From a couple of flat scrap pieces, and a short length of angle iron we made the illustrated support. In one of the flat pieces we drilled a series of equally spaced holes, and in the other, a pair of holes, drilled while the two were at right angles to each other.

The multiple-hole piece is then welded at 45° on one side of the angle iron.

Two capscrews with wing nuts hold the assembly together, and allow adjustments to be made for various wheel diameters.

The support is designed to be clamped in a bench vise over the hand grip of a flexible shaft or portable grinder.

H J Gerber, Stillwater, Oklahoma

Winner No. 256

HARVEY MULLER

won $25 in addition to regular payment for his idea:

GUIDING SMALL DRILLS

in the issue of July 30, 1956

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

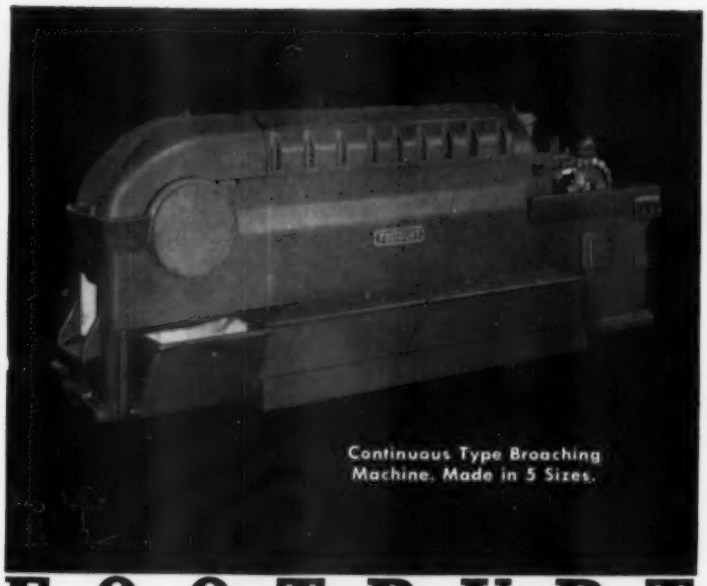
PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

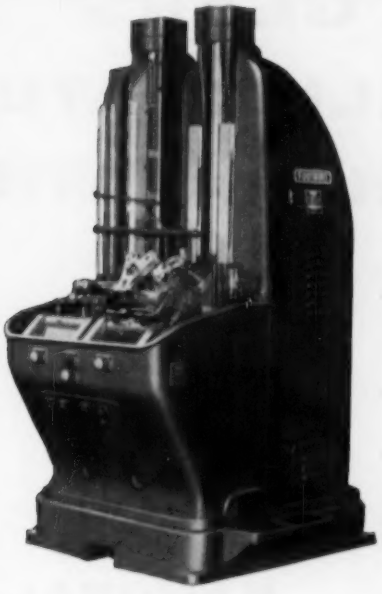
WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



Continuous Type Broaching Machine. Made in 5 Sizes.

Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.



FOOTBURT

a faster *More Economical* machine operation

■ Footburt Surface Broaching may be the answer to your problem of faster machining. Many jobs that were slow and expensive when handled by conventional machining methods are now being produced by Surface Broaching. Production in most cases is as fast as the speed at which parts can be loaded. Yet cutting speeds are so low that the cost of tool maintenance shows great savings. Exceptional finish can be maintained. We will gladly discuss your machining problems with you.

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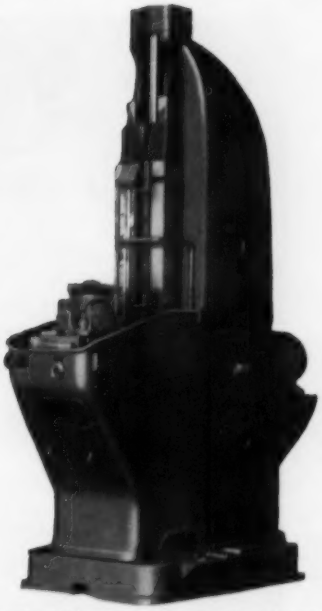

Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

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PIONEERS IN SURFACE BROACHING

NOISY GEARS ELIMINATED AUTOMATICALLY

A consistent electronic ear in the Red Ring Gear Speeder has replaced the human sense of hearing which, as we know, varies with the fatigue and mental attitude of the listener.

This electronic sound discriminator is readily adjusted to reject gears at any point within the range of audible noise frequency and intensity.

The Model GSR Speeder for gears and pinions in the smaller sizes is fully automatic. Gears are loaded, run in both directions, with and without a brake load and are either passed or rejected by the electronic sound discriminator as a continuous operation. ***Write for Details.***

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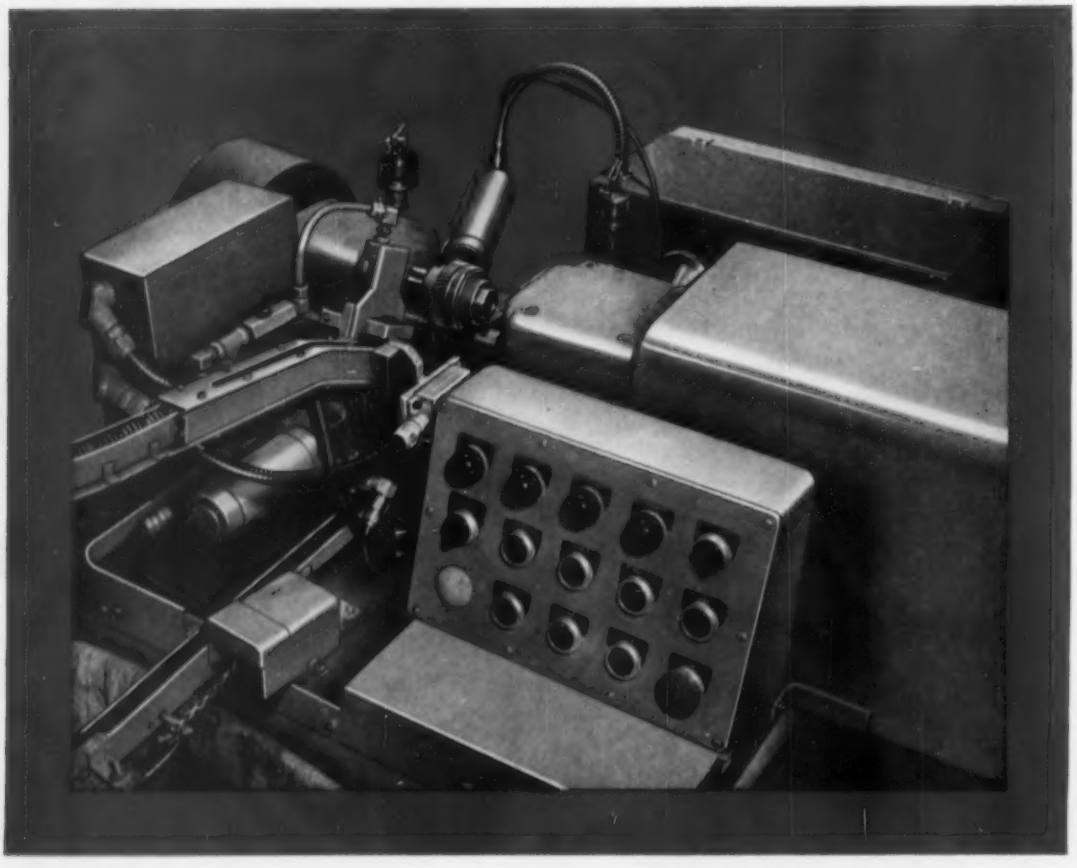


GEAR TOOLING — VII

GLENN TINKLE, gear engineer, ILLINOIS TOOL WORKS, CHICAGO

This series on "Gear Tooling" was begun in an earlier number (AM—Aug 13 '56, p 159) because cutting tools for production of generated shapes have undergone considerable development in recent years

ROUND BOTTOM

The "round-bottom" tooth form has fillets larger than those of conventional tooth forms in both radii of curvature and depth of cut. All functional elements are the same as in conventional tooth forms, and round-bottom gears will freely interchange with standard gears.

Round-bottom fillets are roughly semi-circular—little or no root flat remains. They start at approximately the same diameter as conventional fillets, thus allowing equivalent amount of active profile, but result in greater depth of tooth space, which does not decrease the strength of the gear teeth.

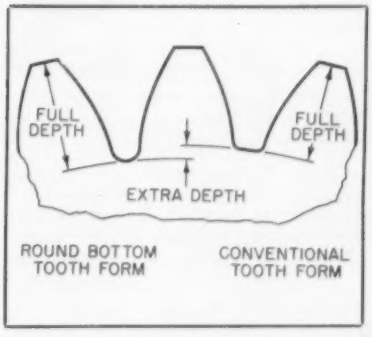


Fig 12—Round-bottom tooth form minimizes fillet stress concentration, results in a stronger tooth capable of longer life under heavy loads

Round-bottom tooth form improves the functional characteristics of gear teeth by increasing the minimum radius of fillet curvature. This can have an important effect on gear life. Normal operation of a heavily loaded gear subjects its teeth to a high degree of fatigue.

Tools to produce round-bottom gears are designed and made like those for conventional gears. Their difference lies only in the nature of the radii at the corners of the teeth and the depth to which they are cut. For round-bottom gears, the contour of the tip of the cutting tooth is based upon a single radius, tangent to the profiles of both sides of the hob teeth at the same point as the smaller corner radii of a conventional tooth form.

Tools for gears of higher pressure

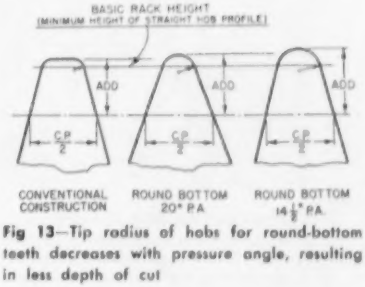


Fig 13—Tip radius of hobs for round-bottom teeth decreases with pressure angle, resulting in less depth of cut

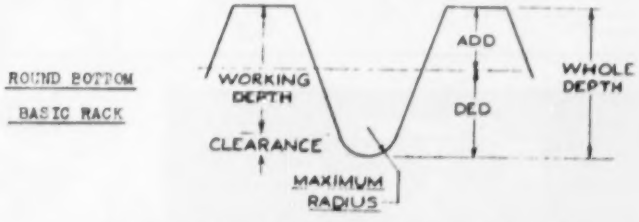


table 4—ROUND-BOTTOM GEAR DEPTHS*

DIMENSIONS FOR ELEMENTS OF TOOTH HEIGHTS

Diametral Pitch	Tooth Element	Tooth Form 14½°PA†	17½° & 20°PA	22½°PA	Full Depth 25°PA	AGMA Stub 20°PA
See Note	Clearance	0.400	0.350	0.300	0.250	0.350
	Addendum	1.0	1.0	1.0	1.0	0.800
	Dedendum	1.400	1.350	1.300	1.250	1.150
	Whole Depth	2.400	2.350	2.300	2.250	1.950
	WHOLE DEPTHS FOR COMMON DIAMETRAL PITCHES					
4		0.6000	0.5875	0.5750	0.5625	0.4875
5		0.4800	0.4700	0.4600	0.4500	0.3900
6		0.400	0.3917	0.3833	0.3750	0.3250
7		0.3429	0.3357	0.3286	0.3214	0.2786
8		0.3000	0.2938	0.2875	0.2812	0.2438
9		0.2667	0.2611	0.2556	0.2500	0.2167
10		0.2400	0.2350	0.2300	0.2250	0.1950
12		0.2000	0.1958	0.1917	0.1875	0.1625
14		0.1714	0.1679	0.1643	0.1607	0.1393
16		0.1500	0.1469	0.1438	0.1406	0.1219
18		0.1333	0.1305	0.1378	0.1250	0.1083

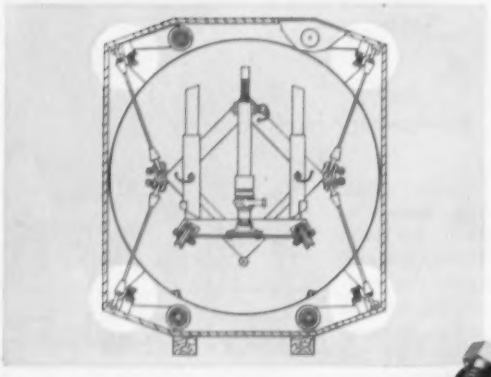
*Illinois Tool Works

†14½° PA is shown principally for replacement gears. It is not recommended for new designs.

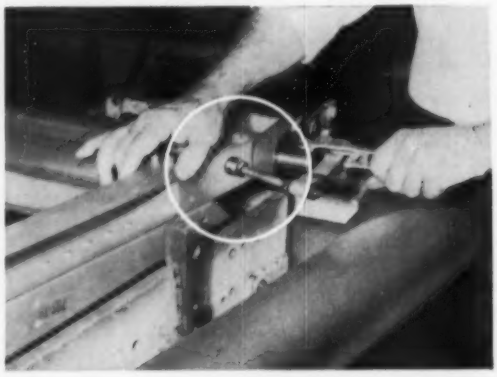
Note: For other pitches divide given DP.

TOOLING IDEAS your shop can use!

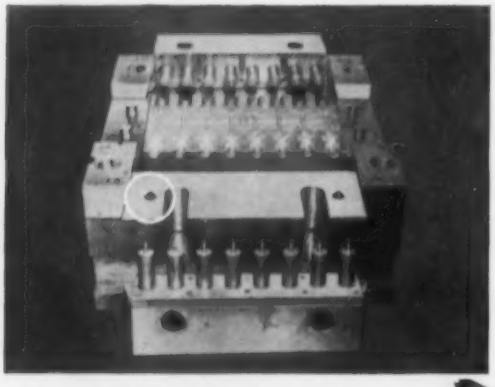
Shown below are just a few of the many uses for Vlier tooling accessories. Although these standard accessories are primarily used in jigs and fixtures, many companies are using them to replace custom-made devices in original equipment.



SPECIAL SWIVEL-PAD CLAMPS for a missile container manufacturer incorporate the remarkable Vlier ball-joint construction. Eight Swivel-Pad Clamps are used to release tension on cables which suspend the missile in its shipping container. This particular model withstands 21,000 load pounds.



CLAMPING PARTS WITH OFF-ANGLE SURFACES is no problem when Vlier Toggle Pads are used with a toggle clamp as shown here. The pad swivels 10° each side of the center line, assuring solid clamping of the part with no damage to the surface.



THIS 16-CAVITY, SIDE-ACTION PLASTIC MOLD uses four Vlier S-66 Spring Plungers as *detents* to lock the side-action bar in its travel to the center of the mold, eliminating costly, custom-made detents formerly used.

New Head Design

on all Vlier Torque Thumb Screws protects working parts from dirt, chips, and other foreign matter. Truarc ring makes disassembly easy. In all Vlier Torque Thumb Screws the ball-check is perpendicular to the screw axis, preventing uneven wear and wobble.

A glance at the new 1956 Vlier catalog will probably suggest many applications in your shop where you can standardize on Vlier accessories. Write for your free copy today.

VLIER ENGINEERING INCORPORATED

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Insist on Vlier Tooling Accessories... there's still no substitute for qual

GEAR TOOLING — VIII

angles are narrower at the tips, restricting the tip radii to smaller values and resulting in less depth of cut.

Hobs, gear-shaper cutters or form-milling cutters may be made to cut round-bottom teeth on either spur and helical gears. For finish cutting the tools are normally made to produce theoretical tooth thickness at a specified depth, without provision for backlash. Unlike conventional tooth forms, the depth of round-bottom gear teeth varies with pressure angles. Table 4 gives the depth of Illinois Tool Works standard round-bottom-tool tooth forms. These depths are recommended for finish cutting. In some cases, greater depth may be required for semi-finish cutting.

Tools for round-bottom gears may incorporate any of the other special tooth form features and are made in the same classes and types as tools of conventional tooth form.

Although highly recommended where its characteristics are needed, the round-bottom tooth form is not suggested for general application. Many factors in production contribute to making gears of this construction more costly. The tools have a higher first cost and the extra depth of cut means more material to be removed, adding to cutting costs.

In some gear designs, the minimum section through the hole or rim will not permit the greater depth of the round-bottom tooth form. An external hub to be cleared by the hob may also prevent the round-bottom feature without revision of design dimensions. Where failure by breakage is not a factor, round-bottom teeth seldom offer practical advantages over conventional construction.

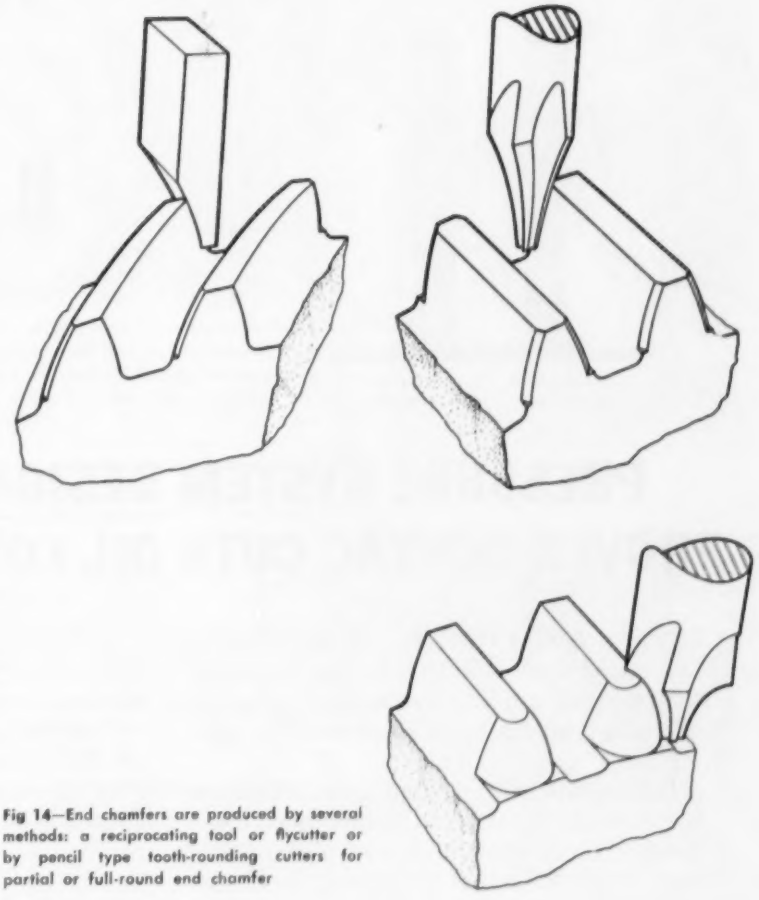
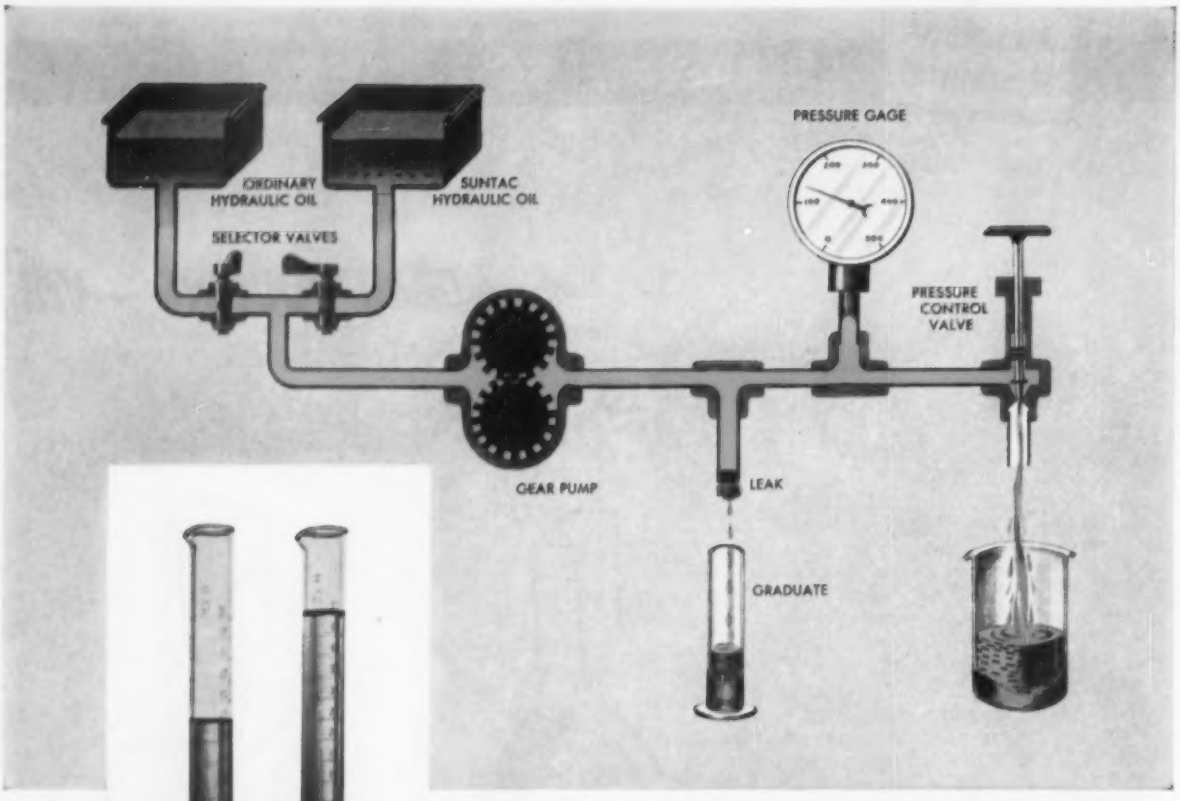


Fig 14—End chamfers are produced by several methods: a reciprocating tool or flycutter or by pencil type tooth-rounding cutters for partial or full-round end chamfer

END CHAMFER

End chamfer takes several basic forms. The first and simplest is a corner break on the acute edge of a helical gear. This chamfer can be cut in several ways, including hobbing or shaping, but is most efficiently produced by special chamfering equipment. This machine employs a single toolbit or form tool in rotation (flycutting) or reciprocation (shaping).

In another form of end chamfer, the ends of spur-gear teeth may be chamfered on both edges to remove burrs and break the corners. Special pencil-type, tooth-rounding cutters, as used for full-round end chamfer, are often found most satisfactory.



The leak rate of ordinary oil vs. Suntac was measured in test machine simulating a typical leak in a hydraulic system. Oil viscosities were equal, time and pressure conditions identical. The simple act of switching from the ordinary oil to Suntac, *without any other changes,* reduced oil leakage by 50%.

PRESSURE SYSTEM DESIGNED TO LEAK PROVES SUNTAC CUTS OIL LOSSES UP TO 50%

If you're having troubles with excessive oil leakage, a Suntac® oil can help you. Because of their unusual anti-leak characteristics, Suntac oils reduce oil consumption up to 90%, users report.

Suntac oils will not gum up or otherwise harm circulating systems. These oils are high-quality petroleum products with a life expectancy longer than that of ordinary hydraulic and circulating oils.

A change to a Suntac oil can lower your oil costs...improve housekeeping...result in safer working conditions.

Your Sun representative can tell you more about Suntac oils. Or write for Technical Bulletin 23. Address SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-10.

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GEAR TOOLING — IX

Full-round end chamfer is commonly used to facilitate tooth engagement of axially shifting gears or clutches. It is produced with pencil-type, tooth-rounding cutters used in special equipment, which controls the travel of the cutter around the ends of the teeth.

Pencil-type tooth-rounding cutters are made in six general styles, some form relieved and some profile sharpened, all ground on form, RH cutting and normally double-ended.

In some cases the specifications for end chamfers permit the use of specially designed chamfering hobs. These hobs usually produce a chamfer that embraces the entire periphery of the gear face. Special hobs for this purpose are usually made full generating with unground form.

Specifications for a hobbed chamfer should permit deviations in both the angle of chamfer and depth of cut to meet processing requirements. Hobbing, for example, may produce a wider chamfer at the root of the tooth space, and at less angle with the face, than it produces on other sections of the chamfer.

For gears and clutches subject to axial engagement, and with drive always in the same direction, a special type of end chamfer may be employed. The most common examples of its application are on starter gears. This type of chamfer may be hobbed, milled, or shaped but hobbing is the most common because of its speed.

Extension of the end chamfer inside the root diameter at the gear face is not a functional requirement, but is an unavoidable concession to sweep of the hob or milling cutter. Hobs for this type of end chamfer are normally made unground, non-generating, single position. The last tooth in the hob thread is the finishing tooth and forms the finished chamfer. All teeth ahead of this last tooth are roughers.

In operation, these hobs may be fed to full depth at the start of the cut and complete the operation in a single revolution of the gear. Form of the chamfer produced is dependent upon the position of the hob. Depth setting, axial position, and angle of table all affect the end result. Such hobs are designed to produce certain end-chamfer specifications on a given part but within a limited range. They can usually be employed to cut similar chamfers on other gears having the same basic gear data.

A right- or left-hand hob is required, according to the side of the teeth to be chamfered and direction of cut desired. Direction of cut is often determined by preference for location of the cutting burr.

CHAMFERING WITH A HOLLOW MILL

Double-sided end chamfer is also used to aid axial shift engagement of gears or clutches. Its most apparent distinction from the full-round end chamfer is the radial land left on the nose of the gear tooth. Tooth-rounding cutters can be set up to leave such a land but, for volume production, this type of end chamfer is most efficiently produced with hollow-mill cutters.

These cutters straddle two or more teeth, deriving their cutting efficiency from the fact that they cut on two teeth (opposite sides) simultaneously. Where the outside diameter of the cutting head does not exceed the shank diameter, which is usually 1 in., they are made double-ended.

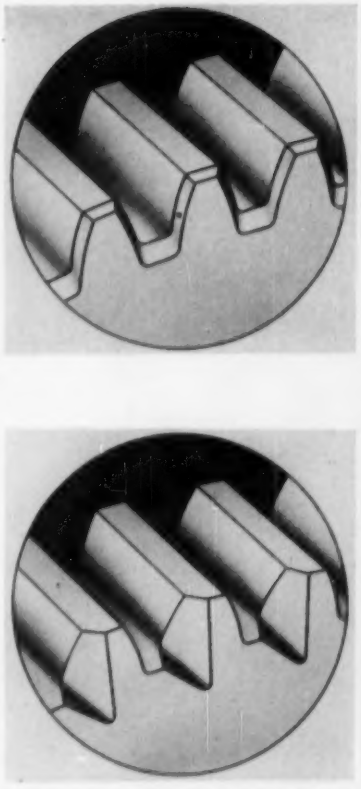
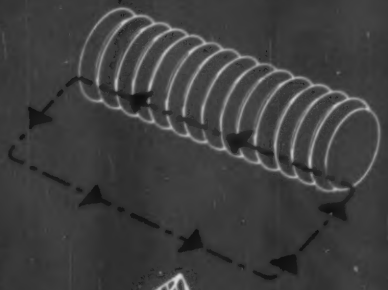
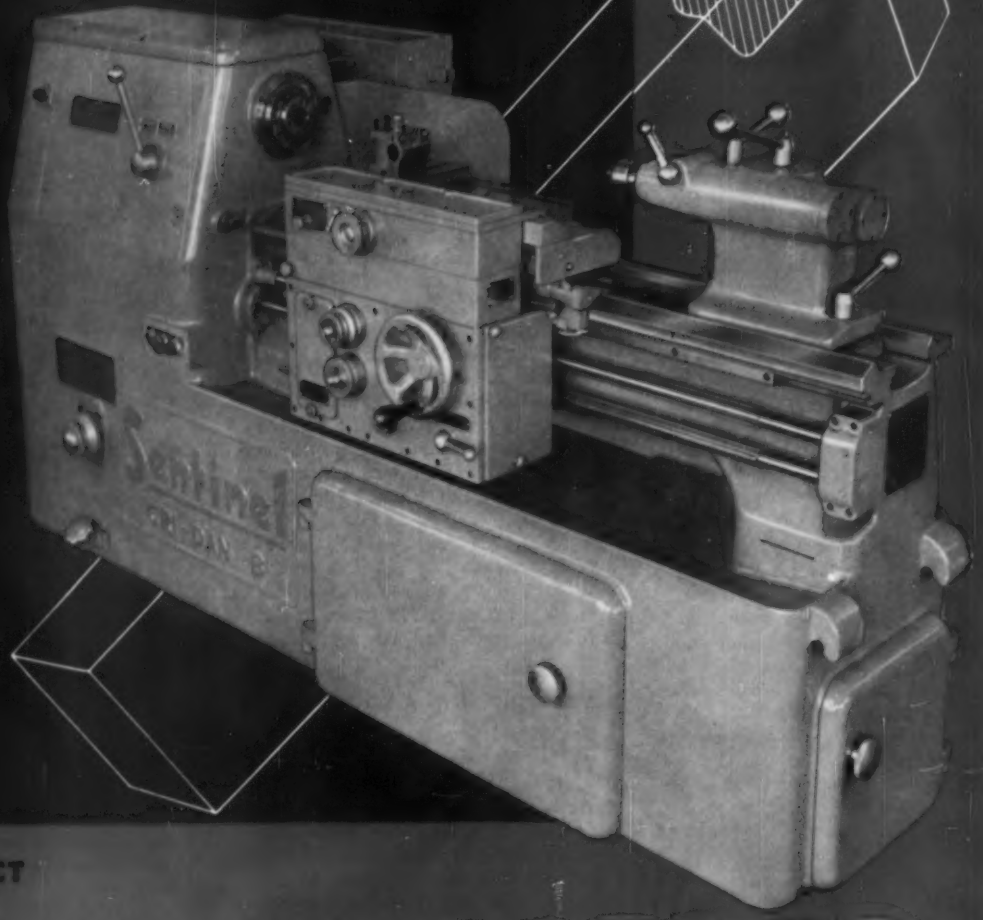


Fig 15—End chamfers can be hobbed too. Top—entire periphery of gear face; Bottom—special cut for gears and clutches subject to axial engagement

Model "B"

CRI-DAN HIGH-SPEED
Semi-Automatic
THREADING MACHINE





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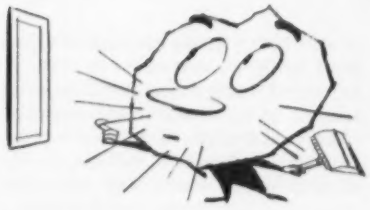


Tin Whiskers

TIN, ZINC, AND CADMIUM grow whiskers like spines on cactus. Eight years ago, Bell Labs discovered that these whiskers cause all kinds of mysterious short circuits in electronic equipment. A radio, for example, stops working, but when you take it to the repairman, it works fine. Several months later, it kicks up again. Now we know that moving the radio in some cases will dislodge the whiskery growth. But they'll grow back— through paint, plastics, and insulation. Normal diameter is only 0.0001 in.—and some that size are hollow! They grow ⅜-in. per year, rate varying with conditions. They are formed of perfect crystals, so are fantastically strong, some showing tensile strengths a hundred times that of the normal pure metal. And they grow from the base—each new crystal forming at the root of the whisker. Heat makes 'em grow faster, humidity makes thin ones grow faster too. If the crystalline structure in the metal is strongly compressed, whiskers grow faster. All these things have been learned in the last eight years—but nobody yet has been able to stop whiskers from growing—and making trouble in equipment when they do.

Goodbye Burr

DOUGLAS-EL SEGUNDO made a group of tiny brass gears, and the machining produced burrs that were too small to remove by any normal means, but caused operating troubles because the gears were anti-backlash type (split, with a spring). The answer proved to be dipping in a glass beaker of acid over an ultrasonic unit. Straight dip in acid didn't work well, but a quick dip in the ultrasonic-agitated area attacked the burrs at the hardest part first—where they joined the gear—and took them off without etching the gear itself.

Operation Training

LYCOMING is the latest company to apply a simple, effective method to training of machine operators—training on productive work but not under production quotas. A machining school has been established in one section of the plant with a cross section of machine types installed. The machines are tooled to produce needed parts but are not part of the production lines. Untrained people are started here, can be trained under close supervision, tried on various machines to see where their aptitudes fit best. Any good work they turn out is welcomed, but a spoiled piece does not risk the wrath of a foreman with a quota to meet. Lycoming, expanding in an area where trained machine operators are scarce, has found the new system eases a lot of tension.

Fire Fighter

BIRDS THAT NEST near the edges of runways create a serious hazard to jet planes during takeoff and landing, and they have already caused a number of accidents by being sucked into the air intake. In an effort to scare them away, a high-power ultrasonic generator was mounted on a truck to be driven down the runways; the idea being that the high-frequency sound would scare them away, at least temporarily.

It didn't work because, after their initial surprise, the birds took no notice of the sound. However, the unit wasn't wasted, as it was discovered that the sound waves possessed unusual ability to snuff out fires when bounced off a wall or other reflecting surface. It looks like a good bet for protecting oil-tank farms.

Better Beryllium

NEW TREATMENTS for beryllium-copper strip, designed to give higher tensile strength and hardness, are reported by John T Richards. Instead of the customary 600 F heat treatments, he suggests:

1. For soft or solution-treated metal, age hardening at 650 F for 3 hr.
2. For quarter-hard metal, hold at 625 F for 3 hr.
3. For half-hard or hard metal, hold at 625 F for 2 hr.

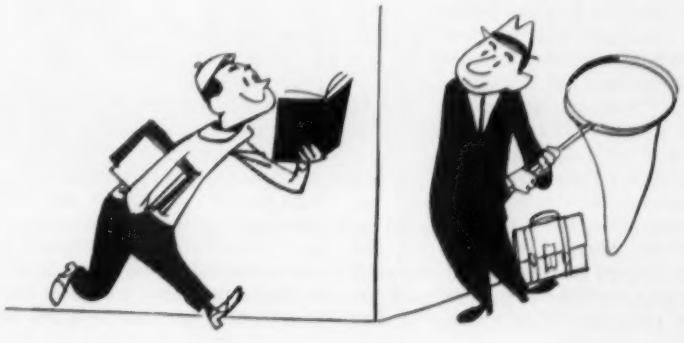
The new treatments are said to produce maximum hardness in beryllium copper containing 1.60 to 2.00% beryllium. Richards is chief engineer of Penn Precision Products.

Humidity Test

A CERAMIC MATERIAL whose electrical resistance varies with the humidity has been discovered by accident at Horizons Inc. The material turned up when results of tests on the material were erratic. Source of the variation was found to be the moisture content of the surrounding air. Now Horizons is seeking to calibrate the ceramic and develop a gage that should be invaluable in instrument assembly.

Perfect Answer

IN OUR EFFORTS to promote the training of more engineers we sometimes hear that there is a danger of training too many (some of us are old enough to remember that a surplus once existed). In an address to the President's National Committee for the Development of Scientists and Engineers, M H Trytten said that as long as engineers are so ardently desired outside their specialties there should be little fear of oversupply.



Ultrasonics Steal the Metal

CLEVELAND — Ultrasonic equipment—for inspection, testing, welding, brazing, soldering, machining, cleaning—shown by more than a dozen firms, caught the spotlight at the Metal Show. Altogether, an estimated $6 million in equipment was on display here October 8 to 12 at this 38th National Metal Exposition and Congress.

For non-destructive testing, Curtiss-Wright exhibited a portable ultrasonic "Immerscope" designed to penetrate materials and detect internal flaws in metal parts at all stages of processing, from raw materials through finished components. Operating on 110 volt a-c power, the package includes the Immerscope, which translates ultrasonic echos into a visible "pip" on a cathode-ray tube, a manual manipulator for positioning a search tube at all angles from the vertical, a longitudinal and transverse manual scanner, and an immersion tank with a detachable platform for the Immerscope.

Branson Ultrasonic showed an array of ultrasonic gages, including a "Vidigage" for non-destructive testing from one side of a part. Applications include production testing and field-corrosion surveys on aircraft propellers, large flat sheets, hollow aluminum extrusions, castings, plate glass. The unit measures a wide range of thicknesses and detects laminar flaws and internal defects.

Branson's portable "Audigage" is a battery-operated device for measuring the thickness of metals, glass, rigid plastics, and similar materials. Another portable, battery-operated thickness gage is the "Coatingage" for the measurement of non-magnetic coatings on magnetic base materials.

Ultrasonic fluxless brazing, welding without fusion, and fluxless soldering were demonstrated by Aeroprojects Inc. For brazing of materials that melt at less than 1300 F, the unit consists of an ultrasonic generator, a head that includes a transducer coupling, brazing tip, and a gas-fired or electrically heated tip. In operation, the high-frequency vibratory energy produced on the transducer is transmitted through a metal coupling to the molten brazing material. This energy breaks down heavily oxidized films on metals and permits molten brazing material to alloy with the base metal.

Similarly, the welding unit employs an ultrasonic transducer-coupling system to produce and apply high-frequency vibratory energy to a weld zone. In this process, the pieces to be joined are clamped at low pressure between two welding members and the vibratory energy is briefly introduced. Result is a solid-state metallurgical bond made in a short time, with low clamping load, low deformation, and no fusion.

A new ultrasonic micrometer developed by the Materials and Process Laboratory of General Electric was described in a paper by H A F Rocha at a Meeting of the Society for Non-Destructive Testing. Principal difference from similar instruments is that its output voltage is d-c, making possible automatic control of machining operations. Properly placed, the micrometer can continuously measure a critical dimension during machining, automatically stop the cut when the dimension reaches a preset value. As a differential gage, it can simultaneously measure and control a group of dimensions during fabrication, such as mean OD, wall thickness, and eccentricity of a tube being rolled or machined. Accuracy of measurement is within 1% of the dimension measured in applications tried to date.

New materials

A process for producing strong, ductile, nodular cast iron was described by Dr Harry K Ihrig, director of research at Allis-Chalmers Mfg Co. The new process uses about 0.45% sodium chloride in the melt and cuts costs of making ductile cast iron in half. Other chlorides have also been tested successfully. To date, about 1400 tons have been produced.

Columbium and tantalum oxides and metals up to 99.5% purity are two products recently developed by Kennametal Inc. In addition to the high-purity columbium now in volume production, Kennametal will also have available a technical grade for industrial research work as well as for commercial purposes. Tantalum metal and oxide of 99.5% purity is also being made on a production basis with widespread applications in several fields, especially for manufacture of electronic components.

Kennametal also exhibited a platinum-base cemented carbide, K501, developed for extremely corrosive conditions. Lower in cost and more wear resistant than noble metals, this material is said to be equal to them in corrosion resistance. Applications include seal rings, metering orifices, bushings, nozzles, and other parts used in chemical processing. A new cemented tungsten carbide hard-facing material was also shown by this firm. This is reported to be stronger than conventional fused and cast tungsten carbide and is available in a range of shapes and sizes.

Ceramic tooling

A combined ceramic and carbide tooling setup by General Electric's Metallurgical Products Dept teamed the two cutting materials on the same machining setup. Problems involved at speeds from zero to 2600 sfpm are solved. A 12½-in.-dia bar of AISI 6140 (BHN 206) was faced in from dead center in less than one minute using carbide for the cut at speeds of zero to 600 sfpm and then switching to cemented oxide for speeds from 600 to 2600. Depth of cut was 1/16 in., 0.0115 ipr.

In the setup demonstrated, standard throwaway insert holders were used with grade 370 carbide at the low speed and grade 0-30 cemented oxide for the high-speed portion of the cut. Tests indicated that using cemented-oxide tools alone for this job would have resulted in high tool breakage, and cutting time with carbide tools alone would have run 3 to 4 minutes. With both tools in the setup, optimum results were obtained relative to tool life and machining time.

New equipment

One of the newest machines exhibited was a heat-treating furnace for carbonitriding, bright hardening, and carburizing small parts. The "Induct-O-Ring" by Lindberg Engineering Co employs induction heating to eliminate heating elements, element terminals, burners, or gas or electric connections in the furnace proper. Its circular shape eliminates

Show Limelight in Cleveland

the heat and atmosphere losses usually caused when conventional furnace doors are opened to change and remove work loads. Operation is automatic and the furnace employs a reciprocating motion. It turns slowly in the direction of work travel, then quickly reverses. With this motion, the work remains in the forward position and regularly progresses through the chamber until it reaches a discharge chute.

Another portable machine demonstrated was the "KIH" hydraulic unit by Utica Drop Forge & Tool Co for cold pressure buttwelding and lapwelding non-ferrous metals. This machine has a capacity for buttwelding up to 3/16 in.-copper and ¼-in. aluminum. Foils on thin sheets can be lap welded. Hobart Bros also showed a new portable welder, their tractor-type submerged-arc welding unit. This automatic unit is applicable for such operations as shipbuilding, shop, or field structural work, for welding large tanks and any other welding operation involving long seams (straight or curved) where the horizontal member is of sufficient size to support the unit.

A new electronic erosion machine for machining carbide, stainless honeycombs, titanium and other difficult materials was exhibited by Abaco Industries. The unit directly reproduces the shape and profile of a soft master electrode in these materials by means of a spark and is said to be accurate within plus or minus 0.0015 in. and can produce a 10 mu-in. RMS finish.

A new electrical-discharge machining application was demonstrated by Elox Corp. Cavities in forging dies were finished after rough machining by conventional methods to within 3/16 in. of finished size. This eliminates finish contour milling and bench operations. Where a pair of die cavities had previously required 32 hours of contour milling and 6 hours of bench finishing, the new set-up does the job with 14 hours of milling and 7 hours of electrical-discharge machining.

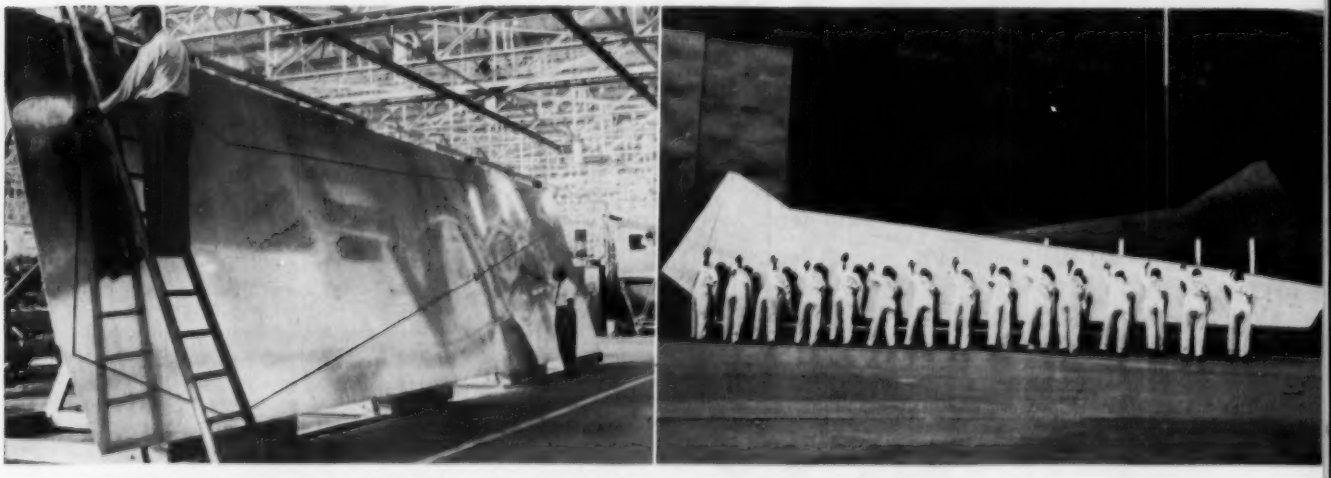
Elox also showed a recently developed electrical discharge "grinder" with an 8 x 24 in. table working surface especially adapted for contour surface finishing carbide parts from the solid. Unique feature of the machine is its ability to produce accurate contour broaches for root shapes on turbine buckets.

East Germany's Exhibit

Trade rivalry between two German optical firms presented a little drama at the show. Carl Zeiss Inc, NY, with a plant at Oberkocken, near Stuttgart in West Germany, exhibited such optical instruments as toolmakers microscopes, metallographic equipment and others. Representing Carl Zeiss Jena, whose main plant is located in Communist-dominated East Germany near Leipzig, was a New York firm, Ercona Corp, with a competing line. The Zeiss Jena Works was captured by the Russians in the industrial grab race that went on between East and West in the last days of World War II.

Welding Award Established

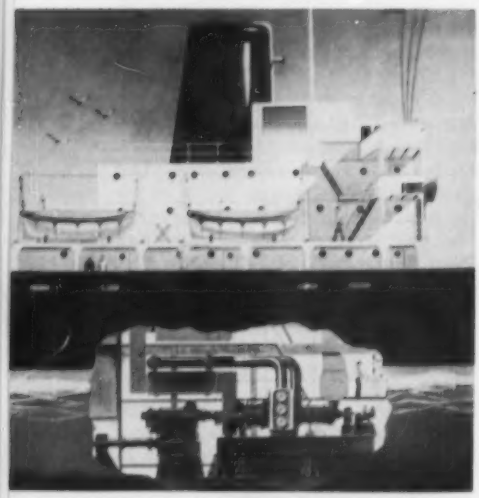
CLEVELAND — Gregory Industries Inc announced at the Metal Show it will present either $1500 in cash or a $2000 scholarship at a school of the winner's choice for "the most outstanding contribution to the further development of electric-arc stud welding" each year. The criteria: (1) reducing costs for industry, or (2) improving the appearance, serviceability and life of a product or structure, or (3) performing a function not possible by any other method. Further information and blanks are obtainable from Gregory Industries Inc, Lorain, Ohio.



Largest tapered aluminum sheet ever rolled . . .

measures 124 in. wide by 550 in., is 0.230 in. thick at the heavy end for 175 in., tapers from that point to 0.129 in. at the light end. Rolled by Aluminum Co of America's Davenport, Ia, plant to taper, the sheets are cut at Douglas Santa Monica (Calif), where eight large sheets are used on the wings of each of Douglas's new DC-8s

Gas-Turbine Ship Heralds New Maritime Era

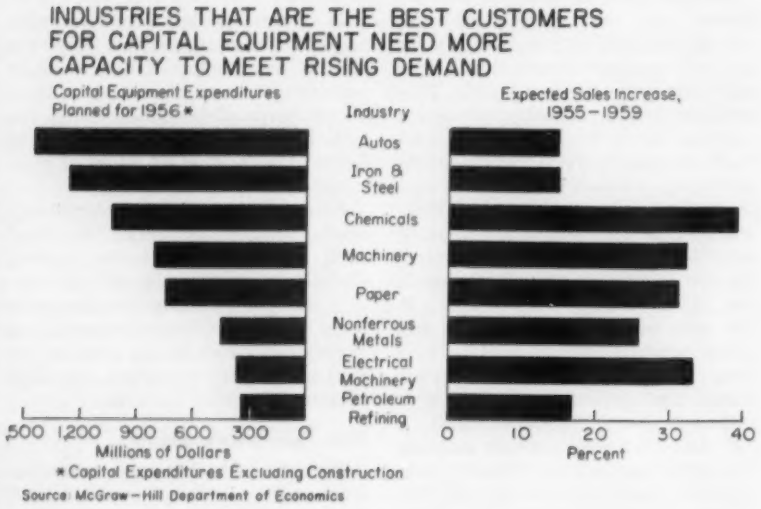


NEW YORK: The world's first gas-turbine powered merchant ship, the *John Sergeant*, a converted Liberty ship that has just completed its first voyage, to Northern Europe, is hailed by nautical experts as the harbinger of a new era in ship propulsion. The *John Sergeant*, with a new bow and the gas turbine now achieves 18 knots, where before it could make only 10. Another first for the *Sergeant* is a giant four-bladed, 17-ft, 6-in. dia controllable-pitch propeller (bottom photo) that rotates at 110 rpm, allows the ship to go astern without reversing the engines, and can be feathered into "neutral" to keep the ship stationary while the engines are running. S Morgan Smith Co built the propeller. General Electric built the turbine

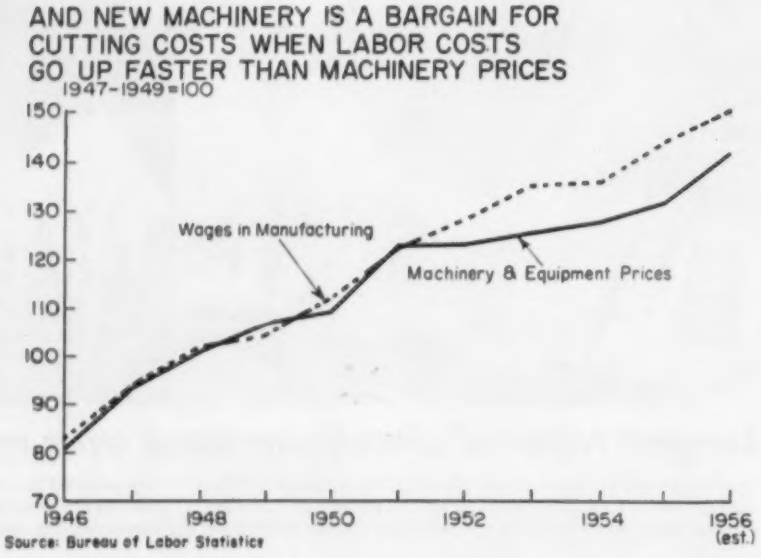
Steady Growth Keynotes

Machinery today is a growth industry—in the next 10 years, look for industrial machinery to run well ahead of business generally in sales and in capital goods buying. Here's why . . .

1 More sales mean more plant...



2 Machines offset high wages...



Future of Machinery Industry

NEW YORK—America's industrial machinery industry is today no longer geared to a boom-and-bust cycle. For perhaps the first time in history, the industry can look forward to a pattern of steady growth based on a solid demand for capital goods and equipment in an unprecedented era of industrial expansion. And, most important, new products are being developed at an unequalled rate, creating a steady turnover of existing stocks of machinery. Added to that:

- Great amounts of new plant and equipment will be needed every year to bolster anticipated industrial sales gains, and nearly 70¢ out of every capital spending dollar goes for machinery (or vehicles) as opposed to construction.

Machinery Is a Bargain

- Machinery is today a better bargain than it has been in many years. In 1951-55 machinery prices rose only 7.4%, contrasted with an 18% industrial wage jump. While both wages and machinery prices have increased this year, there is little indication that wage increases will taper off: thus incentive to install new machinery will continue.

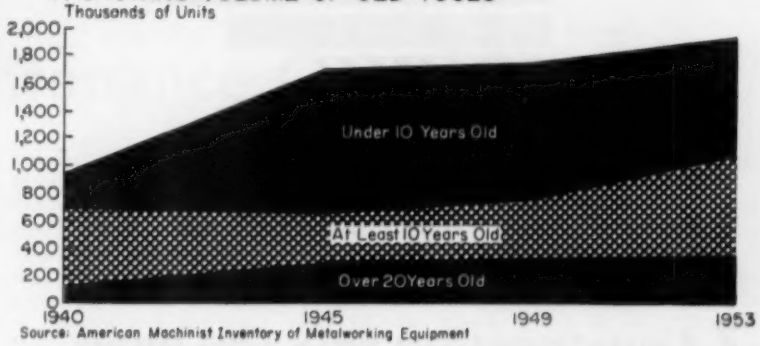
Replacement Market

- The growing number of old or obsolete tools provides plenty of opportunity for replacement. In fact, many of the "new" tools installed in the early postwar years are reaching replacement age.
- To ensure timely replacement, and to provide the capacity for growing markets, companies today are ordering, or planning to order, machinery not just for next year, but for two, three or more years ahead.
- The industrial machinery industry itself is stepping up research and product development to (1) offer the buyer still more opportunities for labor saving through buying of new machines, and (2) to accelerate replacement of older tools.
- And the machinery industry is steadily accumulating capital for continuing expansion of its plant and research facilities. The machinery companies are developing more effective sales programs to use that new capacity.

(Continued on next page)

3 Replacement is urgent...

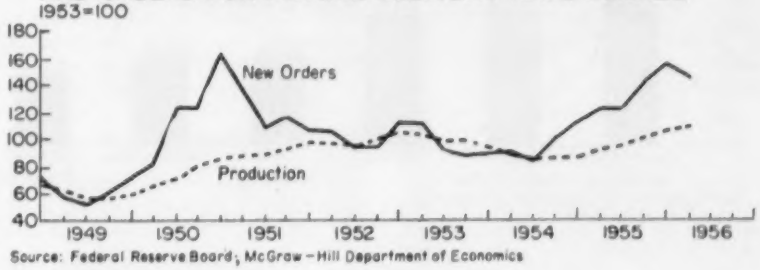
NEW MACHINES ARE NEEDED TO REPLACE A GROWING VOLUME OF OLD TOOLS



Source: American Machinist Inventory of Metalworking Equipment

4 A new plateau of expansion...

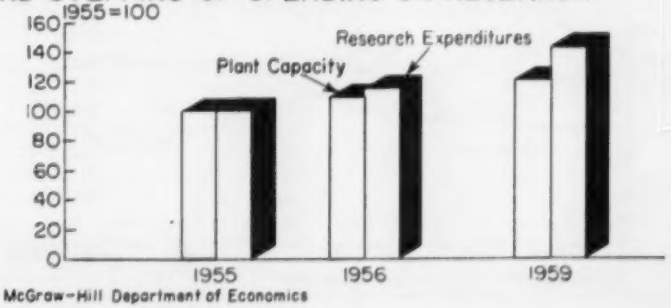
SO MACHINERY OUTPUT IS UP SHARPLY... AND ORDERS FOR FUTURE DELIVERY HAVE SOARED



Source: Federal Reserve Board; McGraw-Hill Department of Economics

5 They spend $ to make $...

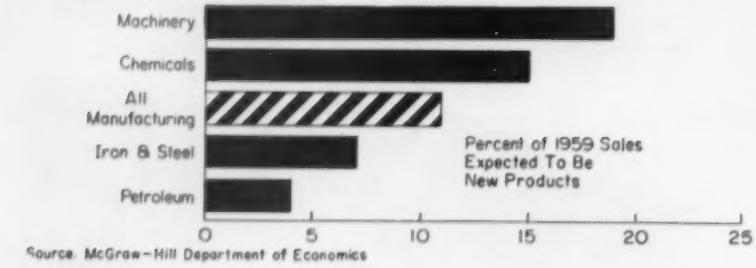
TO HANDLE HEAVY DEMAND, MACHINERY COMPANIES ARE INCREASING CAPACITY AND STEPPING UP SPENDING ON RESEARCH



Source: McGraw-Hill Department of Economics

6 New machines for a new era...

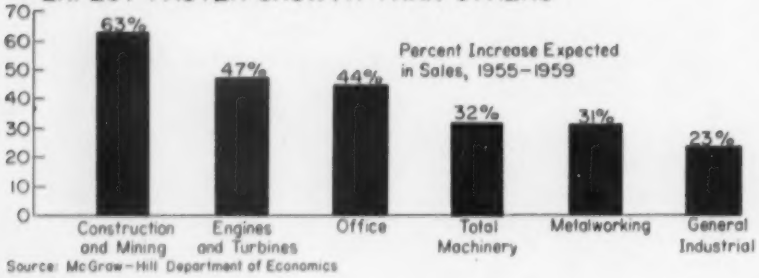
MACHINERY LEADS MAJOR INDUSTRIES IN PROPORTION OF NEW PRODUCTS EXPECTED IN 1959 SALES



Source: McGraw-Hill Department of Economics

7 Construction sets the pace...

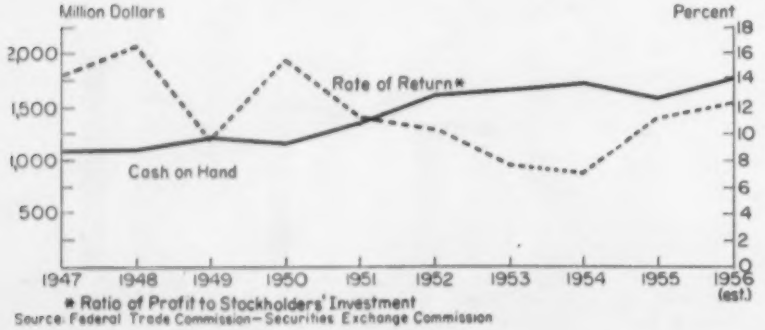
SOME LINES OF MACHINERY EXPECT FASTER GROWTH THAN OTHERS



Source: McGraw-Hill Department of Economics

8 The dollar base is solid...

MACHINERY COMPANIES ENTER THIS EXPANSION PERIOD WITH A STRONG AND IMPROVING FINANCIAL POSITION



* Ratio of Profit to Stockholders' Investment

Source: Federal Trade Commission—Securities Exchange Commission

MACHINERY (continued)

Those are the basic growth factors, but beyond them there have been important changes in the character of the machinery industry that are fully as important as the increase in the industry's business.

For one thing, long-range planning by manufacturing companies, including the placing of orders well in advance, gives the machinery maker a chance to do a better job on his own advance planning. That means he can maintain the engineering staff, the skilled workers, and the plant facilities needed to meet increasing demand. Gone, by and large, are layoffs, staff cutbacks and idle plants caused by feast-or-famine orders.

The faster pace of research is also helping to smooth out the cycle. By bringing out more products, the industry is forcing obsolescence of existing machines—in the same way that the automotive and appliance industries have done. By 1959, almost 20% of sales are expected to be in products that were not sold in 1955. This will certainly shorten the replacement cycle on industrial machines.

New Blood, New Ideas . . .

The boom in capital goods has brought new companies into the machinery field, some of them firms with long experience in developing and merchandising new products. General Motors, for example, has entered the construction machinery field; and several farm equipment makers have diversified into industrial machinery. Also eyeing industrial fields are aircraft makers.

. . . and New Money

This means that big firms with plenty of capital are coming into a field that has heretofore largely consisted of small companies. And in recent years mergers and acquisitions have built up bigger firms within the old machinery group, so that today there is a substantial number of machinery producers with adequate capital to act as leaders in developing new products and new sales methods. Evidence of this is to be found in the Value Line Investment Survey, which of the 28 machinery firms it covered in 1955, listed 11 as having sales of more than $100 million. In 1956, the proportion in these brackets will be even higher.

The higher standards set by these leading firms are reflected in a gen-

eral upgrading of the machinery industry's own plant and equipment. You'll find more automated foundries and machine shops, better materials handling, closer cost control—and better integration, too, with leading producers controlling the output of many components for finished machines. The machinery industry's total bill for new plant and equipment will top $1 billion in 1956, putting it in a class with autos, steel and chemicals—the top spenders.

But one characteristic of the machinery industry remains unchanged—it still embraces a wide diversity of individual products, and of specialized firms to make these products. Thus today the industry is competitive to an unprecedented degree, even in its fastest-growing segments.

Those are the reasons why the machinery industry may well be at the same point today as the automobile industry was in the early 1920s, or the aircraft industry in the 1940s—emerging from a period of spectacular, but not too profitable, invention into a period of sustained and highly profitable growth.

Military Maintenance Goes "Civvy"

WASHINGTON—Maintenance contracting—The servicing and repair of weapons and other military equipment by private companies—was a minor source of defense business until recently. But about one-quarter of military maintenance work is now done by civilian firms and the trend is steadily increasing. Aircraft and electronics companies, who for the most part are the maintenance contractors, are doing hundreds of millions of dollars worth of business yearly.

Trend to Civilian Work

And as weapons become more complex and the shortage of skilled technicians in uniform continues, this trend toward civilian contractors is stepping up. In the Air Force, which hires the bulk of maintenance contractors, expenditures for such work on planes has increased almost 25% in the last two years. From here on out, military maintenance contracting will also increase in the other services and spread to other types of equipment. Even more significantly, contractor work will expand from the heavy depot-type of maintenance, in which it's now concentrated, to the less-complicated, field-shop type of maintenance normally handled by the military itself.

Here are some keys to the future:

- A Defense Dept advisory committee headed by General Electric Co's President Ralph J Cordiner, has been set up to study ways of retaining skilled technicians in the services, and is considering a plan to farm out more operations and maintenance work to civilian contractors as a means of reducing military technician needs.
- The Air Force is about to award a contract to the Federal Telephone and Radio Co, an International Telephone and Telegraph Co division, to operate and maintain the Distant Early Warning Line, the $400-million radar warning net ringing the Arctic Circle. Also in the works are plans to hire a civilian contractor to operate and maintain many of the installations of "SAGE" — the $1-billion electronic air defense control system.
- In the "thinking stage" is a unique Air Force procurement contract under which an aircraft producer would guarantee to keep up to 75% of its product, a new all-weather fighter interceptor, in commission after delivery by having civilian mechanics stationed at Air Defense Command fighter base.

Behind the trend toward increased civilian contractor operation in fields traditionally reserved for the Services is this factor: fantastically complex jet and atomic age equipment has put the military in a bind.

Maintenance Is Tougher

For one thing, it requires far more servicing and repair than old-line arms and equipment. In World War II, for instance, 7.2 manhours of maintenance work was needed to keep a P-51 Mustang fighter plane flying for an hour. Today it takes 15.5 manhours for every hour that an F-86 Sabrejet is in the air. For the F-100 Super Sabre and other latest supersonic aircraft, crammed with fire-controls and other electronic gear and now coming into operation, maintenance demand goes up even more. The same thing applies to complex new ground and naval armament—the Navy's atomic submarines and anti-aircraft guided missile systems; the Army's tanks equipped with gyroscopic-stabilized gun-laying systems; the Army's arsenal of bombardment rocket missiles.

Yet, at the same time, the Armed Forces are unable to get and keep enough technicians with new specialized skills in uniform to do the job. The Air Force reports there'll be a shortage of 57,192 men with "hard core" skills by next June—meaning men skilled in fire-control, navigation systems, and atomic weapon and guided missile maintenance, all of which require up to two years' training. The skilled manpower shortage has increased by 22,717 since last December. For electronic skills, the Air Force says it needs a re-enlistment rate of at least 33% to keep a stable work force economically. But reenlistments in this field are running at only 10%.

Reenlistment Blues

In metalworking skills, the Air Force is doing somewhat better. This year the reenlistment rate is running at 31% for airmen on their first hitch of service, compared to 13.1% last year. For career metalworking specialists, the reenlistment rate is 84% this year compared to 73.4% in 1955.

Breakdown Not Ready

Exact figures on maintenance expenditures by the military services, and on the share going to civilian companies, are hard to come by. For the most part, the Defense Dept doesn't keep total sums. Besides, the services finance maintenance work from as many as 30 different budget accounts. The Air Force lumps its maintenance money with operations costs. The Navy uses money appropriated for shipbuilding and conversion for types of work the Air Force would consider maintenance.

FIELD REPORT

East...

Eastern roundup . . .

American Can Co has purchased **Bradley Container Corp,** Maynard, Mass, maker of extruded plastic tubes and bottles . . . **GE's Small Steam Turbine Dept** has a $2.7 million Navy order to make engine room equipment for three guided missile frigates . . . **Piasecki Aircraft Corp,** Philadelphia, is dickering with several European aircraft makers for cross-licensing and cross-distribution of products . . . **Farrel-Birmingham Co Inc,** Ansonia, Conn, is moving its roll grinder sales and service from Ansonia to its **Consolidated Machine Tool Division,** Rochester, N Y . . . **New York Twist Drill Co Inc** is building a new plant at Westbury, L I, that will double output of its present plant in Manhattan . . . **Joseph T Ryerson & Son Inc** dedicated its 335,000-sq-ft Jersey City, N J, steel service plant September 20 . . . **Kaiser Aluminum & Chemical Corp** is buying the old Air Force aluminum forgings plant at Erie, Pa, which Kaiser has operated for two years under lease, for $2.9 million. Kaiser will spend $5.3 million expanding the plant . . . **H K Porter Co's Riverside Metal Division** has purchased **Prentiss Wire Mills,** Holyoke, Mass . . . **R Hoe & Co Inc,** New York, reports its new **Contract Mfg Division** already has $685,000 in new business on the books, mostly orders for aircraft tools and parts for **Glenn L Martin Co** . . . **New York Shipbuilding Corp,** Camden, N J, will spend $500,000 researching nuclear power for ships . . . **Pratt & Whitney Aircraft,** East Hartford, Conn, reports it has orders for 1700 jet airliner engines on its books . . . **American Machine & Foundry Co** is planning a $4-million research and development center for Stamford, Conn . . . **Toolset Inc,** maker of self-stripping piercing and notching units, has moved to new quarters at 1411 Military Rd, Buffalo . . . **British Industries Corp's** subsidiary, **Shaw Development Corp,** has completed a pilot foundry and lab in Port Washington, L I, to train Shaw Process licensees . . . **National Tool & Die Manufacturers Assn** has won a National Safety Council award for its work in promoting safety in small business . . . **GM's Rochester (N Y) Products Division** is making fuel injection units (optional on the '57 Chevvy) . . . World's biggest steel and titanium extrusion press is now operating at **Curtiss-Wright Corp's Metals Processing Division,** Buffalo. Built for the Air Force Heavy Press Program, the 126 ft long press has a squeeze of 12,000 tons.

"Optical Equipment Only" Toolroom . . .
at Boeing Seattle has more than 50 such items in stock—a far cry from World War II days, when optical equipment was still a novelty in the aircraft industry

South...

Dixie briefs . . .

Ingalls Industries, Birmingham, has a $3-million contract to help build the first privately financed atom power station for New York's Con Edison at Peekskill, N Y . . . Columbia, Ala, is angling for an unidentified metal-and-woodworking industry that would employ 400 . . . **Calumet & Hecla's Wolverine Tube Division,** Decatur, Ala, plans to boost its tube producing capacity 40% . . . **General Cable Corp** is planning a 60% expansion of its Tampa, Fla, power cable and building wire plant . . . The state of North Carolina says $118.5 million worth of new or expanded plant was planned there in the first nine months of this year . . . **Lockheed Marietta** has a new $100-million Air Force contract to make C-130 Hercules propjets. Present workforce will handle the job without expansion . . . **Gravely Tractor Co,** Albany, Ga, will build a new 30,000-sq-ft tractor plant. It'll employ 200 . . . **LeTourneau-Westinghouse** will add 40,000 sq ft to its Toccoa, Ga, earthmoving equipment plant—cost $1.5 million . . . **L B Foster & Sons** will make steel products at Norcross, Ga . . . **Meat Separator Machines Inc** plans a $100,000 plant in Atlanta . . . **Industridoor Inc** will make steel doors in a new $80,000 plant in Atlanta . . . **Lockheed's Georgia Division** has a $4.5-million contract to start construction on the Air Materiel Command's **Georgia Nuclear Laboratory,** Dawsonville, Ga . . . **Armco Drainage & Metal Products Inc** has started to build a $500,000 steel fabricating plant in Atlanta . . . **Yale & Towne Mfg Co** will build a 120,000-sq-ft materials handling equipment plant at Forrest City, Ark . . . **Chance Vought Aircraft Inc,** Dallas, has a new Navy order for $200 million for additional output of F8U-1 fighters . . . **Glenn L Martin Co** has bought a 10-sq-mile tract outside Orlando, Fla, will use it for electronics, nucleonics and missile facilities.

West...

Scanning the West . . .

North American Aviation has been awarded a $2.2-million Air Force contract to research titanium alloys for planes and missiles. Work will be done at Los Angeles . . . **Northrop Aircraft** is talking merger with **Vertol Aircraft Corp** of Morton, Pa,

helicopter maker . . . **Norris Thermador Corp,** Los Angeles, is making $5 million worth of stainless steel, copper-bottomed cookware for **National Presto Industries** . . . **Rheem Mfg Co** is combining its Wedgewood stove line with **Western Stove Co's** Western-Holly ranges for a broader line . . . **American Can Co** has negotiated a nationwide contract with the **United Steelworkers of America** that calls for a 21.5¢ hourly wage boost over a 3-year period. First hike started October 1 . . . **General Motors** now says its Sunnyvale, Calif, plant, originally slated for completion in time to make '58 models, won't be ready until the '59s go into production. Reason: GM keeps modernizing and updating the plant . . . **Aeromotive Metal Products Inc** will start work shortly on a $350,000 steel door plant at San Jose, Calif . . . **Varian Associates,** Palo Alto, Calif, expects to complete a microwave vacuum tube plant in Stanford Industrial Park next summer . . . Industrial expansion in the San Francisco Bay area in first half 1956 hit a record $250 million, topping the rest of the west. Transportation equipment headed the expansion list with $105 million. Third, after the food industry, was electrical machinery with $23 million, and machinery was fifth with $15 million . . . Plans are going ahead for **Sperry-Rand Corp's** proposed up-to-100,000-sq-ft plant at Deer Valley, outside Phoenix . . . Wyoming is the newest state to get "attract industry" conscious, has hired a Chicago industrial consulting outfit to look into its industrial potential . . . **Standard Products Co's** West Coast Division is quadrupling its auto window-channel manufacturing facilities with a new 72,000-sq-ft plant at Fullerton, Calif . . . **Harvey Machine Co,** Torrance, Calif, has formed **Harvey Aluminum Structures** to engineer, fabricate and erect aluminum structures . . . **Worthington Corp,** New York, has acquired the former **Royal Jet Inc** plant at Alhambra, Calif, will make furnaces and air-conditioning components there . . . **Boeing Airplane Co** has firm orders for 134 Boeing 707 jet stratoliners, giving it the edge in the jet transport sales race over **Douglas's** 114 orders . . . **New Plastic Corp,** Los Angeles, has bought out **Lansco Die Casting Co,** El Monte, Calif . . . **Moore Drydock Co,** Oakland, has a contract to modify 6 cargo ships as floating data stations.

Midwest...

Midwestern briefs . . .

GM is building a 582,500-sq-ft plant at Hudson, Ohio, for its **Euclid Division.** It'll employ 1500 . . . **Thomas Hydraulic Speed Controls Inc,** Wichita, Kan, has bought out **Aircraft & Automotive Products Inc,** also of Wichita . . . **Carborundum Co** has just about completed its $30 million abrasive wheel plant at Logan, Ohio . . . **Trane Co,** La Crosse, Wis, heating and air-conditioning equipment maker, will build two new plants and double its research facilities at a cost of $13 million in the next two years . . . **Ferguson Machine & Tool Co,** St Louis, has (1) acquired a new plant at Lebanon, Ind, where it will design and build automatic tooling for use with the company's basic transfer units, and (2) has changed its name to **Ferguson Machine Corp of Indiana** . . . **Tipp Mfg Co,** Tipp City, Ohio, has formed a **Controls Division** to make packaged industrial controls for "virtually any function that can be measured electrically" . . . **Eaton Mfg Co's Axle Division** will spend $3.5 million to expand manufacturing facilities at Cleveland . . . U S Labor Dept survey shows Chicago tool and diemakers averaged $3 an hour last winter . . . **Weldex Inc,** maker of resistance welders, has moved to 18425 Weaver St, Detroit . . . **IAM's Lodge 113, Die and Tool Makers,** has been voted out as bargaining agent in two Chicago area firms—**Era Tool & Engineering Co,** Franklin Park, Ill, and **International Register Co,** Chicago . . . **American Seating Co,** Grand Rapids, Mich, will make $3.5 million worth of milled extrusions for **Douglas** DC-8 jet transports . . . **Advance Stamping Co** is moving to bigger quarters at 12025 Dixie Ave, Detroit . . . **Lincoln Electric Co,** Cleveland, is building a $5.5-million addition to its welding equipment plant . . . **Aro Equipment Corp,** Toledo, will spend $2.5 million on expansion and replacement in the next five years . . . Some 500 employees of **Cleveland Cap Screw Co** recently put in a five-hour shift at time-and-a-half on a Saturday, promptly turned their wages for it over to Cleveland's Community Chest. This voluntary charity workday has been going on at the company every year since '47.

"Double Whammy" Tube Brazer . . .

Just installed by Varian Associates Inc at its San Carlos, Calif, plant, this double-barreled furnace will braze copper assemblies for Klystron tubes at 4 times the former rate. The furnace is on a track so that it can cover either of two muffles raised into it. (Muffles are hoods 24 in. diameter by 11 ft high, piped for atmosphere and "forming gas.") Each is over a pair of coaxial rams; the inner raises the assembly to the desired level in the muffle and the outer raises the loaded muffle into the furnace. Tube assemblies of copper up to 1½ x 4 ft can be brazed. Atmosphere is 75% H_2, 25% N_2, while the "forming" gas is 90% N_2 and 10% H_2. To speed cooling of a muffle, it is lowered into a water jacket just below the furnace-support track and air is forced between the two. During cooling, a stack on the carriage with the furnace is centered over the muffle and conducts heated air to a roof vent. Designed by Varian engineers, the furnace was built by Pacific Scientific Co, Los Angeles. It is being used to process a $4-million order for V-87 Klystrons received early this year. The furnace is about 16 ft high and 20 ft long

Europe Gains in World Tool Market

WORCESTER, MASS — European machine tools are drawing closer to American ones, technically speaking, than they have ever been, according to Norton Co's Everett M Hicks, who recently visited European machine tool and metalworking plants.

European builders, Mr Hicks says, are growing "much more conscious of the need for putting more weight in their machine tools, building them more precisely. . . . And interestingly enough, the growth of automatic loading and positioning controls, duplicating attachments and things of that kind is striking as compared with prior practice."

While Europe's machine tools generally have come a long way in recent years, U S builders still enjoy a substantial market on the Continent for special high-production machines that have not yet been developed there. Mr Hicks believes that as the high-production industries, especially automotive, continue to develop in Europe, demand for such machines will increase to the point where foreign builders will produce their own. "I'm referring particularly," Mr Hicks says, "to machines like our cam grinders, crank grinders, and multiwheel grinders."

Comparing American-made grinders with those he found in Europe, Mr Hicks claims that European machines have achieved neither the ruggedness nor the precision of U S machines. But, he says, Europe is building its grinders heavier, putting more horsepower into them, and "it is only a question of time before Europe will be able to catch up with our present situation quality-wise. It is important for us to keep up our development program so that we can continue to stay out in front."

American FOB prices on, say, cylindrical grinders are currently running some 75 to 100% higher than British or German ones. This is readily understandable when you consider that in Germany, for instance, wages are approximately in marks what we pay in dollars—and the exchange rate is 4 to 1. Not only that, the Germans and other Europeans have nothing that even nearly approaches our fringe benefits.

For example, in Germany a first-class machine operator gets the equivalent of 63¢ an hour. In the United States, his counterpart gets around $2.50 an hour. At Norton, the lowest wage paid is to sweepers, who get $1.66 an hour. In Germany, a sweeper gets about 1-1/5 marks an hour, or 30¢.

U S labor costs thus become the most important factor in the pricing of American-made machine tools. On top of that, American builders pay relatively more for such components as castings and electrical equipment. Obviously, say Mr Hicks, if U S builders are to compete seriously with European builders in the overseas markets, we must make much better machines, and make them more efficiently.

European Tool Influx

Why aren't low-priced European machines flooding the U S market then? There's little to prevent it, Mr Hicks says, except that so far American-built machines are superior in quality, are heavier and more powerful, and geared to mass production. And if a European builder wants to aim for a big share of the U S market, he must obtain good distribution—something that's not easy to do—and he has to offer top-notch service on his machines.

When you add the difficulties of distribution and servicing to international shipping, insurance and export boxing, and then tack on the 15% U S import tariff for machine tools, 15% to 20% is just about the maximum price advantage a European machine could achieve over an American one in the U S market.

Such a mass flooding of the U S market with foreign machine tools would not only be disastrous to the American machine tool industry, Mr Hicks believes, but to our national defense and to metalworking in general: "We would not be in a position to deliver needed machine tools in the event of a mobilization need. And further, there would be a strong chance that repair-part service would be cut off if the source of our productive equipment were some country outside the United States."

American machine tool exports are definitely feeling the pinch of foreign competition. Says Mr Hicks, "Traditionally, the United States has been a great export nation for machine tools and, until recently, the U S industry exported between 20 and 25% of its total output. However, with the great discrepancy in wages, manufacturing costs and selling prices, this percentage has diminished in recent years to where it is now running slightly below 10% of total U S output."

Training Machinists in Greece

Students at work in the machine shop of the Sivitanidios Technical School in Athens, run by the Greek Ministry of Industry. The school has some 760 students, who pay $3.33 a month for tuition in such courses as metallurgy, automotive mechanics, electro-mechanics, machine shop and carpentry

Wallace B Bainton (see below)

Wallace E Anderson (see below)

Albert S Burgoyne has been appointed vice president, manufacturing of E W Bliss Co. He was formerly in charge of sales of instrument gages for Pratt & Whitney Co's Gage Division

Names in the News . . .

Wallace B Bainton, vice president, production and engineering, of Brown & Sharpe Manufacturing Co, has been named vice president and general manager for machine tools. **Wallace E Anderson,** general sales manager of the company, has been appointed vice president and general manager for industrial products. In a reorganization of management structure, the Machine Tool Division and the Industrial Product Division will each operate with separate engineering, production, and field sales organizations. Assigned to the Machine Tool Division are: **Charles M Evans** as manufacturing manager; **Harold S Sizer,** director of design, machine tools; and **Alfred L Hurst,** assistant to the vice president and general manager. Divisional sales will be directed by Mr Bainton, assisted by **Thomas F MacLaren** as director of field sales; **James Meehan,** director of milling and grinding machine sales; and **Alfred R Sparrow,** director of screw machine sales. **George F Patterson** is in charge of production planning and order service. The Industrial Products Division under Mr Anderson is staffed by **William A McGregor** as manufacturing manager; **Kenneth V Gordon,** director of production ordering; **Harold B Schott,** general sales manager; **Victor S Lindstrom,** field sales director; **William T Nystrom,** director of precision tool and gage sales; and three sales supervisors: **Colin Sharp,** metal cutting tools; **J Arthur Lord,** pumps; **Stuart F Hall,** screw machine tools. Changes in the production organizations of both divisions: **Ermand L Watelet** succeeds Mr McGregor as superintendent of the precision tool and gage group; **Duncan H Doolittle,** formerly director of manufacturing engineering, is superintendent of the miller and grinding machine group; **Thomas C Roberts** succeeds him.

A Lightfoot Walker, executive vice president of Rheem Manufacturing Co, has been elected president and chief executive officer. **Richard S Rheem** has been named chairman of the board, and **Donald L Rheem** vice chairman.

John C Virden, a director of Eaton Manufacturing Co, Cleveland, and a member of the executive committee, has been elected president of the company, effective Jan 1. He succeeds **Howard J McGinn** who has been serving as board chairman and president, and who will continue to head the board. Mr Virden will resign as chairman of the board of the John C Virden Co, Cleveland manufacturer of lighting equipment, which he has headed since 1929.

Roland J Ahern has been elected president and general manager of Peck, Stow & Wilcox Co, Southington, Conn, manufacturer of sheet metal working machinery and tools. Mr Ahern will continue to serve as board chairman of Pexto, as well as president and general manager of the parent company, Billings & Spencer Co of Hartford, Conn.

Gene R Voigt, assistant to the general manager of the Air Tool Division of Aro Equipment Corp, Bryan, Ohio, has been promoted to divisional sales manager.

William C Mullin, chief gage sales engineer, Pratt & Whitney Co, has been named sales manager for instrument gages, Gage Division. He succeeds Albert S Burgoyne (above).

Steven S Gordon has been appointed assistant general manager of Republic Gear Co, Detroit subsidiary of Gear Grinding Machine Co.

G W Keich, executive vice president of Borg-Warner Corp's recently acquired Ingersoll-Humphreys Division, Mansfield, Ohio, has been appointed president, succeeding **D J Jones.**

David R Kendell has been appointed superintendent of manufacturing operations at the new facility being constructed at the La Grange, Ill, plant of General Motors' Electro-Motive Division.

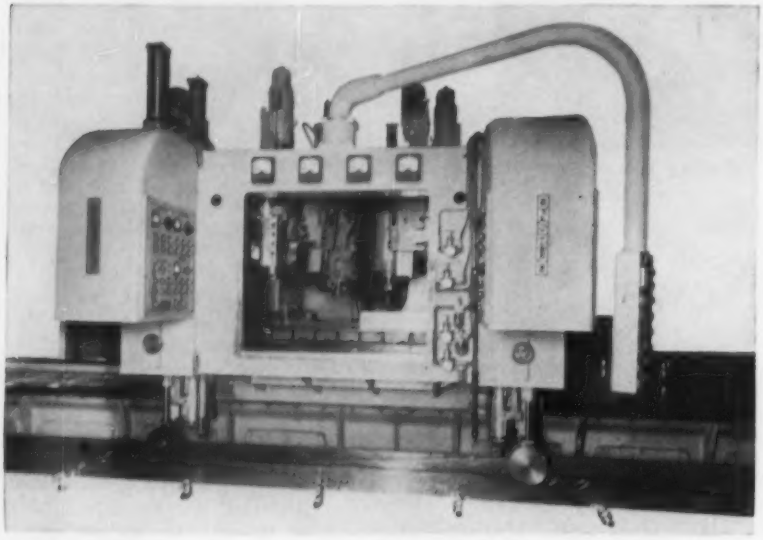
Elmer D Robinson, assistant to the president, Morse Chain Co, Ithaca, NY, has been appointed director of manufacturing.

OBITUARIES

Nathan Ransohoff, founder and chairman of the board of Ransohoff, Inc, Hamilton, Ohio, manufacturer of metal cleaning and finishing machinery, died Sept 24.

Joseph L Mullen, head of the Machine Tool Section in the Navy's Bureau of Ships, died Oct 4 in Washington. A professional mechanical engineer, Mr Mullen had been in government service since 1933.

Arthur B Knight, Jr, former vice president of Norton Pike Co, Littleton, NH, died Sept 30.



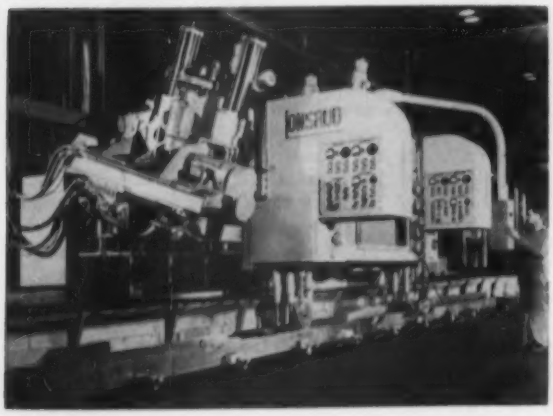
CARRIAGE OF GIANT MILL carries four milling heads and travels over bed. Templets of work to be duplicated by automatic tracer control are positioned near machine base

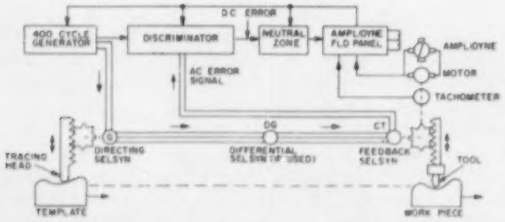
Giant Onsrud Contour Milling Machine Is Controlled by Electronic Tracer

First of a group of 18 machines ordered by the Air Force, Model A-90-24 automatic contour milling machine is an 84-ft unit for milling spar beams and parts up to 60 ft long. A gantry-type carriage houses four cutter motors that together develop over 320 hp, with an available total of 12 different feed motions, all under electronic tracer control. Machine relies upon 38 electric motors for its operation and includes 7.4 mi of wire and cable. It will be employed in the manufacture of spar and wing chords and wing skins for use in all types of aircraft. Huge unit is capable of making a number of cuts from a single setup, where previously several machines might have been required.

Design called for twelve controlled motions, so that one-dimension tracer control, which uses mechanical linkage between templet and cutter, would have produced too complicated a design. Problem was overcome through the use of an automatic tracer control developed by General Electric. System provides for selsyn-type one-dimension tracers, in which only an electrical tie is required between templet follower and the controlled motion, thus greatly simplifying design. Machine is equipped with twelve such tracer-control systems integrated into a single machine control, so that it is possible to operate from 1 to 12 machine feeds simultaneously, automatically controlling the position of four spindles. Machine is normally set up with multi-purpose tooling fixtures which allow almost complete machining of a part before it leaves the stationary workbed.

Control system works in the following manner: On linear feed motions, each 400-cycle G E selsyn is connected so that it makes one revolution for each half-inch of motion. A corresponding selsyn is connected to rotate in relation to a follower which traces the configuration of lineal cams or templets mounted parallel to working surface and located near machine's base. As templet height changes, selsyn con-





SELSYN TRACER CONTROL, shown in block diagram, represents equipment necessary to control one feed motion. Machine is provided with twelve such feed motions

HORIZONTAL HEAD can, under electronic tracer control, be raised or lowered (vertical feed) in combination with varying of angular position on either side of vertical plane to produce twist milling cut

Materials and Parts . . .

nected to follower head rotates at one revolution per half-inch of change. By connecting templet follower and feed-drive selsyns, an error signal porportional to the difference in angular position of the two selsyns is obtained. Because one selsyn is connected to the cutting head and another is following templet which is to be duplicated, the resulting signal provides a measure of the difference between tool position and the templet. Control uses this signal to direct a dc drive motor and operate the feed motion to keep tool in correspondence with the templet, resulting in a cut corresponding to configuration of the templet.

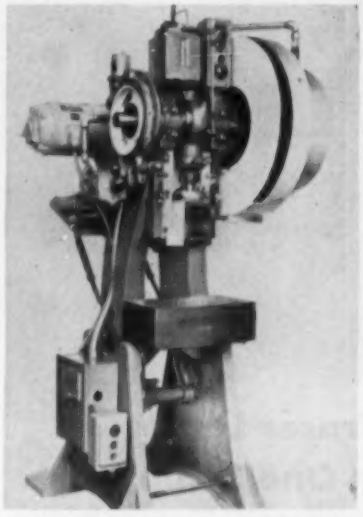
Four spindles, each with three available motions, are controlled by tracers. Two spindles are mounted vertically and two horizontally to provide necessary variety of cuts. Independent motion of the carriage is provided by a 5-hp G E Thymotrol adjustable-speed drive. As carriage moves along machine, follower heads move along templet at same rate.

Test results indicate that the machine is capable of providing repeat cuts to accuracies of 0.002 in. at production rates as high as 300-ipm carriage feed and 30-ipm head feed. Company reports that a 1-in. depth of cut 7 in. wide on rise and fall with changing transverse and twist motions can be made.

Machine is designed to permit doubling of present horsepower loads without overloading structural components. Size and capacity of machine can be realized from some of the elements built into it: 167 control stations, 36 safety-control limit switches, 423 cu ft of cabinet space housing electronic control equipment, 80-gpm use of coolant, and total weight without tooling of 90 tons.

Bed of stress-relieved cast iron is made in five sections, has total length of 84 ft, and provides working length of 60 ft by 35 in. wide. Carriage or gantry, made of cast iron and steel, has longitudinal feed infinitely variable from 0 to 340 ipm; rapid traverse is over 300 ipm.

Onsrud Machine Works, Inc, Metalworking Div, 7720 Lehigh Ave, Chicago 31, Ill



Zeh-Hahnemann Presses Offered In Several Redesigned Types

Available in reclinable, straight-side, and double-crank types, series of presses called High Production has been designed to meet demands of automation and increased productivity.

Construction is engineered for maximum rigidity with minimum deflection. Relationship of flywheel to crankshaft is such as to eliminate bending stresses from the flywheel. Features of the line include air clutch and brake, variable-speed drive, automatic lubrication, overload protection, adjustable stroke, electro-pneumatic controls, and speed ranges up to 600 spm.

Zeh & Hahnemann Co, 182-7 Vanderpool St, Newark 5, NJ

Automatic Centering Machine Operates at 360 Pieces Per Hour

Unit designed to perform a centering operation on parts such as motor cam shafts and crank shafts incorporates two opposed Govro-Nelson automatic drilling units.

Operator loads part into fixture and depresses start cycle switch; work is automatically clamped, centered at both ends, and unclamped, ready for removal. Minor changes adapt it to a variety of parts.

Govro-Nelson Co, 1933 Antoinette, Detroit 8, Mich

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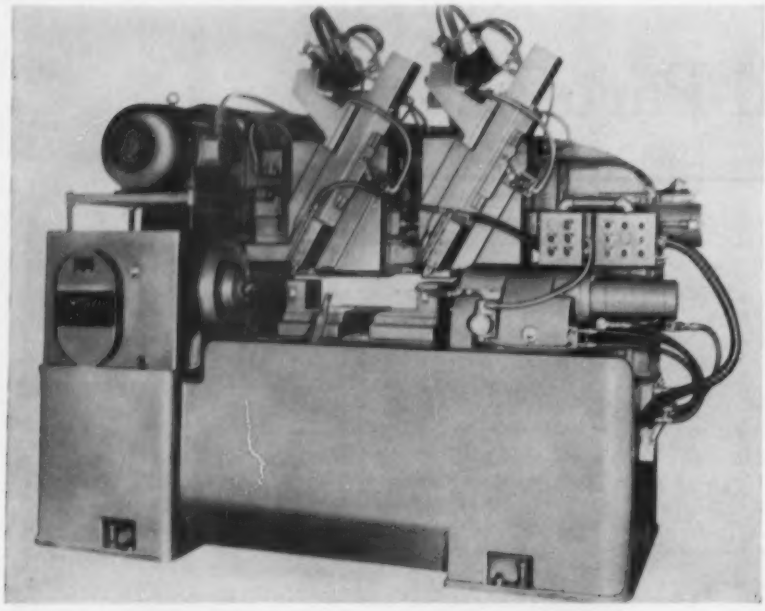


Hydra-Feed Double Tracer Lathes Rough-, Finish-Turn in One Setup

Parts which are normally turned with multiple tooling and require separate machines for rough and finish operations—such as axle shafts, motor shafts, and camshafts—can be handled in a single setup on double tracer lathes. Several basic tracer combinations are offered: right- or left-hand mounting of tracers or combination of both; tracers mounted in tandem with a single hydraulic feed cylinder; or individual feed cylinders supplied for each tracer.

Two different machining sequences are possible. In the first, traversing rear carriage operates first to perform multiple-tool roughing operations, after which the top-carriage tracer slides move in for templet-controlled tracer turning. In the second, top-carriage-mounted tracers perform their turning, after which the rear slides are used for form-tool grooving and undercutting operations.

Mounting of tracer controls and templet on the top carriage provides clear view for operator of the tracer stylus, cutting tool, and workpiece at all times. Dust and chips will not gather on the vertical slideways.

Three basic sizes—HDT-8, HDT-12, and HDT-16—are available, with swing over carriages being 11½, 13, and 17 in. respectively. Length of work that can be handled is 24, 36, and 48 in. for the models. Either a constant spindle speed or a variable-speed drive for constant surface cutting speed can be supplied.

Hydra-Feed Machine Tool Corp, 730 W 8 Mile Rd, Ferndale, Mich

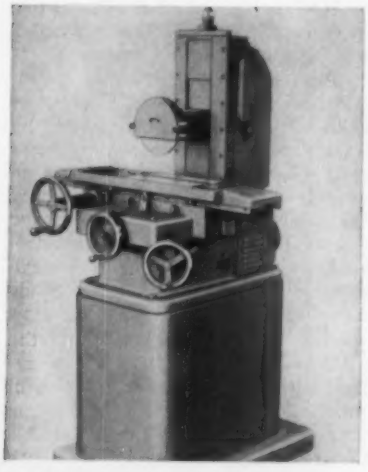
Rockwell Drills Accommodate Six Different Spindle Adapters

15-in. drillpress added to company's line is offered in a wide range of models, priced at less than $150. Extra ruggedness is provided by four oversized, pre-loaded ball bearings incorporated in the spindle construction. Heavyweight head and 2-in.-dia quill add to rigidity.

Machine's six separate spindle adapters feature taper mounting and are locked on the spindle with a threaded collar. With these adapters, unit can perform such operations as counterboring, tapping, surface grinding, routing, mortising, plug cutting, and wood shaping. Drill capacity is ½-in. dia in cast iron, ⅝ in. in steel. Slow and high-speed models offer a range of 470 to 4600 rpm. Machine is powered by a 1/3 or ½-hp motor.

Company is also producing a 20-in. drillpress, with capacity of 1-in.-dia holes in cast iron, ¾-in. in steel. Several models are offered with speed range from 260 to 1760 rpm with a 1140-rpm motor, or 400 to 2600 rpm with a 1725-rpm motor. All models may be obtained with or without a power feed attachment. Single-spindle floor model is priced at $365.

Rockwell Mfg Co, 460 Lexington Ave, Pittsburgh 8 Penna

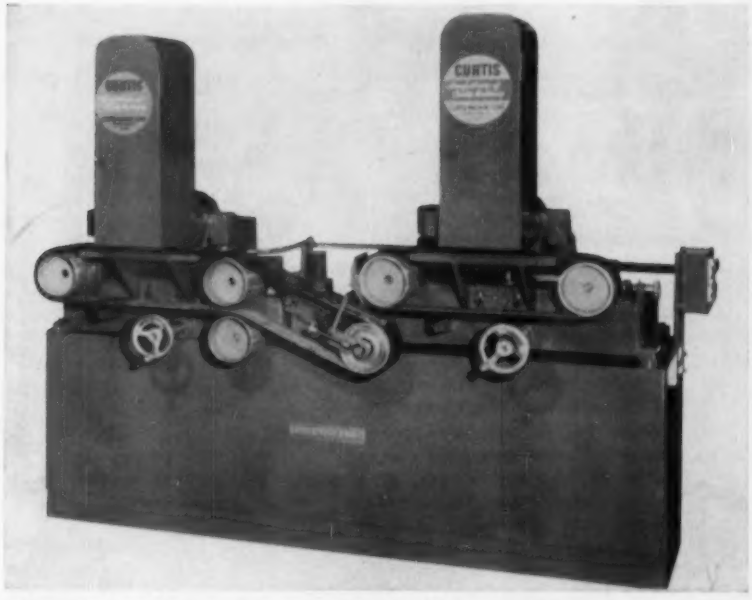


Hand-Feed Surface Grinder

Excel No. 7A hand-feed surface grinder is reportedly a low-cost machine which incorporates several "big machine" features. Elevating handwheel is located below level of table, so that operator can see graduations on wheel and point of grinding-wheel contact with work at the same time. Position of wheel also eliminates need to reach over head when grinding wheel is brought down.

Floating dial pointer eliminates need to add or subtract in determining amount of stock to be removed. Timing-belt drive actuates table; there is no rack and pinion. Leadscrews are made from special steel and threads are precision ground. Special plating process applies a hard-chrome surface to the V- and flat-ways.

Covel Mfg Co, Dept 71, Benton Harbor, Mich



Curtis Automatic Machine Offers Double-Side Grinding Operations

Model 304C2 double-side grinder, which reportedly can be engineered to accommodate practically any workpiece, is a version of company's Straight-O-Matic machines. Incorporating a turnover transfer unit between conveyorized abrasive-belt heads, machine will grind, polish, or deburr both sides of work in one handling.

Machine uses abrasive belts 4 in. wide by 54 in. long and incorporates a 1½-hp motor and two ¼-hp infinitely variable speed conveyor drives. Other models, with unlimited width capacity, are available.

Optional equipment includes additional tandem heads, wet grinding, oil mist, hold-down rolls and magnetic chucks.

Curtis Machine Corp, Jamestown, NY

Setko Hopper-Fed System Applies Headless Setscrews

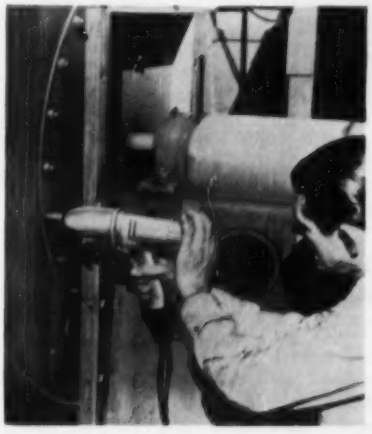
Previously offered only in a floor model, hopper-fed system for applying headless setscrews is now also offered in a bench model. System is designed for use with company's screws, made in a wide variety of types.

In operation, screws are automatically channeled from a vibrating hopper down a guide tube directly to the work, right-side-up and properly positioned for driving.

Set Screw & Mfg Co, PO Box 3537, Bartlett, Ill

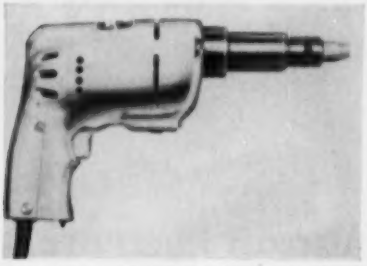
Black & Decker Power-Tool Line Is Augmented by New Models

Impact wrench designed for cool running, durability, and speed is a feature of several additions to company's line of portable power tools. Tool, which weighs 7 lb, delivers 1800 impacts per min and cannot become stalled or overloaded. Special



company-built motor provides identical power output for operation either in forward or reverse. Special centrifugal fan and ventilating system keeps device cool under all operating conditions. Wrench reaches its maximum torque in 6 sec. Drill bits from 3/16 to 1/2 in. in size can be driven, as well as hole saws, masonry bits, and thread taps. A right-angle head attachment is also available for close-quarter operations.

Portable electric screwdriver, called No. 10 Scrugun, has been changed in design so that operator can hold tool like a gun, facilitating work that requires screwdriving in awkward positions (previous model was available only with a center-drive design suitable for overhead suspension in assembly work). Tool

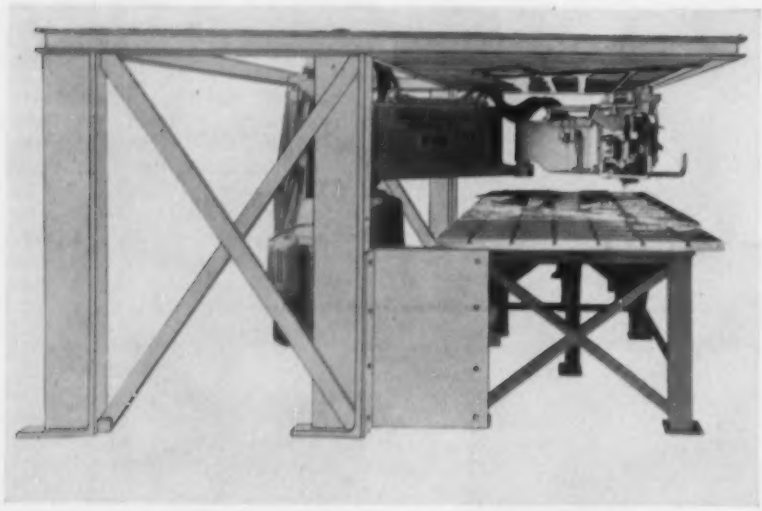


contains a clutch designed to keep the screwdriving mechanism disengaged until operator applies pressure; thereafter tool keeps driving until pressure is released. Mechanism allows operator to have full control of torque when driving screws in material where differing grains and densities require varying degrees of power. Gun can also be adjusted so that clutch disengages after a certain pressure has been reached.

Power speed control developed for use with company's powered screwdrivers provides a means of controlling both power and speed of the units. With the control, an infinite number of instantaneous adjustments are possible to drive screws far smaller than those for which the tools were designed. No. 8 Scrugun, for example is designed to drive screws of No. 8 size; with the control, adjustments of finger lightness can be set by dial, and screws down to No. 0 can be driven. Adjustments can be duplicated by re-setting the dial in the same position, so that operator can drive any number of different screws with instant changeover of power and speed for each.

Portable electric drill of ¼-in. size, designated Holgun, can be used wherever a professional drill is needed for jobs not requiring continuous, assembly-line production. Lightweight tool weighs only 3¼ lb, can be handled for long periods without fatigue. A companion to company's heavy-duty ¼-in. Holgun, this standard unit is priced at $42.

Black & Decker Mfg Co, Towson 4, Md



Aircraft Parts are Routed and Milled On Ekstrom, Carlson Radial-Arm Units

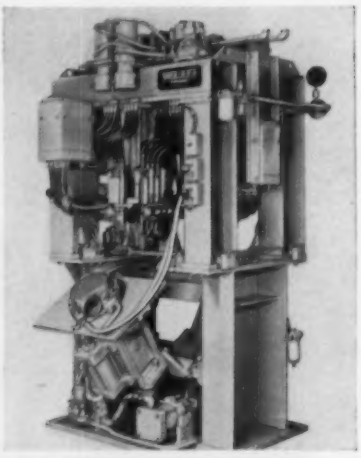
Depth and contour mills, designed to perform intricate machining operations on airframe parts, are similar to company's Cav-Ro-Mils described in an earlier issue (*AM*—Mar 26 '56, p150). Basic machine consists of a heavy column-like base carrying a sturdy, jointed radial arm. At the end of the arm is mounted a high-cycle, high-speed, direct-drive cutter motor which is available with adjustable speeds as high as 14,000 rpm and as low as 3600 rpm. A T-slotted table under the arm holds the aluminum slab to be machined.

Machines come in two sizes, the difference being principally in the length of the radial arm. No. 480, larger of the two, has a maximum arm extension of 120 in. from column center to spindle center; machine has a 60 x 120-in. worktable. No. 484 is smaller, with maximum arm reach of 60 in. and a 30 x 60-in. worktable.

An optional accessory with either machine is a canopy structure to which can be mounted an overhead templet. To use such a templet, an overhead follower is attached to the upper part of the outer arm so that it lines up directly with the cutter spindle. Follower is retractable and adjustable by a remote-control hydraulic mechanism. Illustration shows Model 480 equpped with canopy.

Cutter motor is slide-mounted and independently adjustable for depth of cut by a separate hydraulic cylinder. Other features: water-cooled motor, mist lubrication, guaranteed depth-cutting performance to 0.005 in.

Ekstrom, Carlson & Co, Rockford, Ill



Separate Platens Facilitate Work On Sciaky Resistance Welder

Model SX-36-6 air-hydraulic multiple-spot-electrode welding machine is engineered for high-production resistance-welding applications. Machine consists of a universal multiple gun base with two separate platen units. Platen units, operating independently, load in extended position, swing in and lift to welding position, and, after weld sequence is completed, retract and swing out for unloading. This feature permits multiple spot welding of deep-drawn sections and facilitates loading and unloading.

Welding control is supplied as a free-standing, floor-mounted unit. Control incorporates non-synchronous "squeeze, weld, hold, and platen delay" timing sequence. It also provides for simultaneous or cascade firing of the ignitrons by means of a selector switch, so that power demand can be reduced when desirable.

Sciaky Bros Inc, 4915 W 67th St, Chicago, Ill

Hammond Polishing Lathe Finishes Small Parts

Model 5-ROL high-speed polishing lathe with shortened spindle is designed for hand-finishing small parts. Unit uses a 5-hp motor and has speed up to 6500 rpm.

Model has dynamically balanced, ball-bearing spindle, with either flat or multi-V-belt drive. Unit has a combination brake and switch, operated by a single lever, for instantly stopping spindle and cutting off motor current before brake is applied.

Hammond Machinery Builders, Inc, 1618 Douglas Ave, Kalamazoo, Mich

Threaded Fasteners Locked By Chemical Sealing Process

New method of locking nuts, bolts, and screws uses a chemical sealant called Loctite. Liquid hardens automatically in the joints between metal parts, sealing joints pressure-tight and bonding parts together with a tough, heat- and oil-resistant plastic.

Machinery assembled with nuts and bolts which have been wetted by brief tumbling with sealant reportedly will not loosen under severe vibration conditions because mating threads become filled with hardened plastic. Treated fasteners can be easily removed with ordinary tools.

American Sealants Co, Trinity College, PO Box 260, Hartford 6, Conn

Synchronous Speed with Induction Simplicity

NEW *Synduction* Motor

MORE

Motor Pioneering by Allis-Chalmers makes constant speed sure and inexpensive

Constant speed from no load to pull-out regardless of load and voltage fluctuations . . . simple across-the-line control . . . fixed speed ratios for a group of synchronized drives . . . high power factor . . . high efficiency — every one of these characteristics is included in the greatest motor design advance in years, the *SYNDUCTION* MOTOR.

Here is a motor that combines the simple dependability of squirrel-cage construction with the constant speed advantage — and none of the complications — of other types of synchronous designs.

Available in all squirrel-cage enclosures and in ratings from ¼ to 40 hp, the *Synduction* motor means new operating economies at lower initial cost in many industries.

Synduction is an Allis-Chalmers trademark.

Have You An Application Requiring:

1. unvarying speed; 2. operation of several motors at fixed speed ratios; 3. adjustable speed with minimum variation at any speed setting? If so, Allis-Chalmers invites your inquiry. Contact your nearby A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis., for Bulletin 51B8440.

A-C ALLIS-CHALMERS

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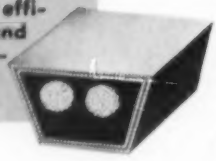
A-5110

TEXROPE
Greatest Name in V-Belt Drive

The Only Complete Line of Variable Speed V-Belt Drives

Texrope Fixed-Speed Drives

For transmitting power efficiently between motor and load where speed variation is not required.



Texrope Grommet Belts

This heavy-duty construction gives from 30% to 50% longer life at no extra cost. The grommet is endless, eliminating the stiff overlap that sets up strains and causes eventual breakdown in ordinary belts. Oil-resisting and static-conducting belts also are available.

Magic-Grip Sheaves

Designed for fast, easy mounting and dismounting. You simply slip the assembled unit on the shaft, slide it to the desired position and tighten the screws which clamp the split tapered bushing on the shaft. The result is safe, smooth-running performance.

Stationary Control *Vari-Pitch* Sheave

where speed changes are infrequent and machine can be stopped to make the change.

9% to 38% Speed Variation

One *Vari-Pitch* sheave and one fixed-diameter sheave are used to get this speed variation. Here's the low-cost way of providing variable speed. No need for high-cost special motors or electrical control. Takes only a few minutes to alter pitch diameter to change speeds.

To 196% Speed Variation

Two *Vari-Pitch* sheaves — one on the driver shaft and one on the driven shaft — can greatly increase the range of speed variation. *Vari-Pitch* sheaves provide long-lasting, dependable performance, plus accurate speed control.

Motion Control *Vari-Pitch* Sheave

for applications where frequent changes must be made while drive is in motion.

Single motion-control type for speed variations to 38%. Simply turning a handwheel provides positive speed change using motion-control *Vari-Pitch* sheaves. Handwheel actuates adjusting mechanism to change sheave pitch diameter and adjust belt tension by moving motor base.

Double motion-control type for speed variations to 196%. Motion-control *Vari-Pitch* sheaves can be used on both driven and driver shafts. In this case changes in pitch diameter of motor sheave are offset by an opposite change in the driven sheave — thus maintaining constant belt tension.

Texrope, Magic-Grip and Vari-Pitch are Allis-Chalmers trademarks.

For further information ask your Allis-Chalmers Distributor or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin

ALLIS-CHALMERS

A-4845

FYI
FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI – these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 PLASTIC VACUUM FORMING & PACKAGING MACHINES — *Product Packaging Engineering, 5747 Marilyn Ave, Culver City, Calif.* 4-page illustrated brochure contains detailed descriptions of Pak-O-Vac machines for plastic forming, drape and vacuum forming, contour or skin packaging; advantages, performance data, dimensions listed.

2 THREAD ROLLS & HOLDERS — *Reed Rolled Thread Die Co, PO Box 350, Worcester 1, Mass.* 8-page illustrated bulletin 1-16 gives information on standardized rolls and holders for single roll applications. Selection data, capacities, dimensions, price list included; thread rolling attachments described.

3 DOUBLE STROKE COLD HEADER —*Waterbury Farrel Foundry & Machine Co, Waterbury, Conn.* Illustrated bulletin covers design features of Headmaster model that can head rivet and screw blanks at rates of 300 to 450 per minute. Tabular data gives maximum and standard tool sizes for the machine, and specifications.

4 ROTARY GANG SLITTERS—*Stanat Manufacturing Co, 47-28 37th St, Long Island City, NY.* 16-page booklet illustrates and describes complete line. Sheet and coil slitting methods summarized; operational details, tables of cutting capacities and machine specifications included.

TOOLS AND ACCESSORIES

5 CARBIDE & CARBIDE-TIPPED TOOLS—*Nelco Tool Co, Manchester, Conn.* 6-page illustrated bulletin 56 gives tabular data and prices on a selection from 700 tools including cutters, mills, slitting saws, shell milling cutter arbors, drills, and centers.

6 GRANITE SURFACE PLATES — *Collins Microflat Co, 2326 E 8th St, Los Angeles 21, Calif.* 78-page illustrated technical manual gives details on Microflat black granite surface plates and precision inspection accessories.

7 MILLING CUTTERS—*Viking Tool Co, 1000 Nichols Rd, Shelton, Conn.* 29-page catalog 561 pictures and describes light, medium, and heavy-duty cutters available in HSS and carbide. New extra-heavy-duty carbide face mills and end mills that take up to ⅝-in. depth of cut in steel are covered, as well as inserted blade cutter line.

8 DISTRIBUTION SYSTEMS FOR AUTOMATIC LUBRICATORS—*Bijur Lubricating Corp, 151 W Passaic St, Rochelle Park, NJ.* 12-page illustrated bulletin 4A describes detailed planning of systems and applications to wide range of machinery. Components discussed and pictured.

9 CONTINUOUS NON-CONTACTING RADIATION GAGES — *Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 12-page bulletin contains detailed information on Rad-I-Acc X-Ray gages for metals and Beta-Ray gages for non metallic materials produced in continuous strip. Advantages, principles, components, engineering data; automatic control units illustrated and described.

10 ANALYSIS, CONTROL, & DATA PROCESSING—*Consolidated Electrodynamics Corp, 300 N Sierra Madre Villa, Pasadena, Calif.* 32-page general catalog pictures and describes range of instruments. Evaluation by dynamic testing discussed; devices covered include recording oscillographs, galvanometers, datagraphs, amplifiers, vibration and pressure measuring equipment, digital data processing, Sadic systems, mass spectrometers.

11 METROLOGY — *Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill.* Three reprints of papers presented at Symposium on Engineering Dimensional Metrology (England) are available: "Large Scale Metrology;" "Work on Engineering Dimensional Metrology at the National Physical Laboratory;" "New Precision Internal Measuring Machine."

HEAT TREATING AND WELDING

12 WELDING POSITIONER—*Worthington Corp, Positioning Equipment Div, Plainfield, NJ.* Illustrated bulletin B-1700-S17 P gives specifications, description, and illustration of heavy-duty Model 240

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FYI
FOR YOUR INFORMATION

for manual and automatic welding, as well as for scrafing and beveling. Unit has 24,000-lb max capacity.

13 RADIATION PYROMETERS — *Minneapolis-Honeywell Regulator Co, Wayne & Windrim Aves, Philadelphia 44, Penna.* 26-page illustrated catalog C 93-1 describes Radiamatic radiation detectors for temperature measurement. Construction features, specifications, accessories, typical applications covered for various models.

PLANT SERVICE EQUIPMENT

14 BARREL FINISHING WITH TUMBLEX ABRASIVES — *Norton Co, Worcester 6, Mass.* 76-page illustrated booklet (Form 501) includes data on types of barrels, selection of abrasive, cleaners, time cycles, case histories of variety of applications.

15 CONVEYOR PULLEYS—*R & J Dick Co, 1 Sade St, Passaic, NJ.* 12-page catalog CP-80 covers complete Barry line including solid steel pulleys, lagged, and split steel. Detailed specifications, prices, descriptions included.

16 LIFT TRUCKS—*Hyster Co, 2902 N E Clackamas St, Portland 8, Ore.* 12-page illustrated brochure describes 25 models with capacities from 1000 to 30,000 lb.

17 WET-BLAST EQUIPMENT — *Cro-Plate Co, 747 Windsor St, Hartford, Conn.* 56-page spiral-bound catalog contains illustrated, descriptive material on line of manual, semi-automatic, and fully automatic pressure blast equipment. Case histories cover range of applications; standard units described, and types of abrasives used discussed.

18 FLUORESCENT LIGHTING EQUIPMENT—*Benjamin Electric Mfg Co, Des Plaines, Ill.* 36-page bulletin B illustrates and describes 394 units. Accessories, construction, and lighting data included.

19 CONVEYOR EQUIPMENT—*Prab Conveyors, Inc, 30121 Groesbeck Hwy, Roseville, Mich.* 47-page catalog 500 contains illustrated data on Magnavator, an automatic elevator for handling small parts magnetically; Tube-Veyor; parts feeders; and custom-built units.

PARTS AND MATERIALS

20 "SPEED REDUCER ENGINEERING MANUAL" — *Westinghouse Electric Corp, PO Box 9099, Pittsburgh 30, Penna.* 48-page booklet B-6727 presents complete application information—hp ratings, torque capacity, overhung load values, dimensions, construction features, installation and maintenance for single, double, and triple reduction. Units may be driven by electric motors, gas, oil, or diesel engines.

● ALCOA HAND FORGINGS—*Aluminum Company of America, 1501 Alcoa Bldg, Pittsburgh 19, Penna.* 16-page technical data booklet discusses factors involved in production. Minimum mechanical properties of the three standard hand forging alloys listed in tables; finish allowance, dimensional tolerances, and straightness tolerance in graphs. Request direct on company letterhead.

21 PNEUMATIC CONTROLLERS — *Bristol Co, Waterbury, Conn.* 56-page bulletin A130 contains illustrated descriptions of Series 500W high sensitivity, wide control-band units for temperature, pressure, flow, vacuum, etc. Various control modes available are discussed.

22 FORGINGS—*Allegheny Ludlum Steel Corp, 2020 Oliver Bldg, Pittsburgh 22, Penna.* 30-page catalog gives complete data on smooth hammered forgings, composite die sections, cast-to-shape tool steels, and a new steel finder which gives detailed information on various forging and casting steel grades made by the Forging & Casting Div.

23 AIR CYLINDERS—*S-P Mfg Corp, 30201 Aurora Rd, Solon, Ohio.* 12-page illustrated catalog 110 contains complete engineering data on Series A nonrotating cylinders, valves, and accessories. Cylinders range from 1⅛ through 14 in. in bore sizes.

24 ELECTRIC WELDED MECHANICAL STEEL TUBING — *Walker Brothers, Conshohocken, Penna.* Bulletin MST-856 gives data on shapes and range; Tables list gages, sizes (⅝-in. OD up to 2¾-in.) and weight per foot of round tubing made from 10-10, 10-20, and high carbon steel.

25 CONTROL DEVICES FOR JIC STANDARDS—*General Electric Co, Schenectady 5, NY.* 12-page illustrated publication GEA-6317 describes application features, product data on the machine tool relay, oil-tight pushbutton, solenoid, limit switch, magnetic starter, plugging switch, and pneumatic time-delay relay.

26 SPEED REDUCERS — *Metron Instrument Co, 432 Lincoln St, Denver 3, Colo.* Illustrated bulletin 98 describes Bantam units with max power output of 0.1 hp at the low speed shaft. Standard models and units with anti-backlash feature covered, each available in 400 fixed ratios.

● BRASS, BRONZE & ALUMINUM FORGINGS—*Titan Metal Manufacturing Co, Dept S, Customer Service Div, Bellefonte, Penna.* 32-page illustrated booklet discusses design, properties, and applications, advantages, available alloys with their properties. Includes dimensional tolerance table, complete list of forging terms, ordering data. Request direct on company letterhead.

27 WIRE ROPE ASSEMBLIES—*Macwhyte Co, Kenosha, Wis.* 24-page catalog 5601 pictures and describes Safe-Lock assemblies consisting of a length of preformed wire rope with terminal attached to one or both ends. Includes dimensions, capacities, sizes of both terminals and rope.

28 HYDRAULIC & PNEUMATIC COMPONENTS — *Aircraft Products Co, 200 Church Rd, Bridgeport, Penna.* 72-page bulletin 156 contains illustrated information on standard line of valves. Engineering drawings, tables and flow charts give construction and operating specifications. Special components for aircraft and general use pictured and described.

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New DIAMONITE Superigid TOOL HOLDER

insures maximum performance from DIAMONITE OXIDE CUTTING TOOLS

CLAMP, specially designed and machined to provide uniform pressure over entire length of chip breaker and insure maximum rigidity of tool.
CHIP BREAKER ADJUSTMENT SCREW permits micrometer adjustment of chip breaker to insure most efficient tool performance.
CLAMPING SCREW—Choice of large Allen head or square head with shoulder for maximum clamping efficiency.
LIFT SPRING raises clamp when screw pressure is released, permitting easy replacement and adjustment of tool insert and chip breaker.
CHIP BREAKER—Cemented carbide with ground base to provide full contact with upper face of insert.
SHIM—Cemented carbide with ground faces provides perfect seating and eliminates wobble of tool.

Illustration shows new positive rake holder, 15 degree lead angle BR tool. Superigid holders are also made in neutral and negative rakes as well as 0° lead angles and facing and shoulder styles.

Extensive field and laboratory tests establish conclusively that complete absence of vibration in both tool and work is essential to satisfactory performance of oxide cutting tools.

To provide vital tool rigidity and enable users to enjoy, in fullest measure, the ultra-high surface speeds, superior surface finish and long tool life possible with Diamonite Oxide Cutting Tools, the new Diamonite Superigid Tool Holder is now available for use with Diamonite Oxide "throwaway lozenge" inserts.

Designed especially for use with these Diamonite Oxide inserts, it combines greatest rigidity ever attained in a tool holder with new precision and convenience features to insure vibrationless operation and maximum tool performance.

COMPLETE RANGE OF STYLES AND SIZES

Diamonite Superigid Tool Holders are made in 1" x 1", 1" x 1¼" and 1" x 1½" shank sizes, right and left hand, for ¾" square and ½" included-circle triangular Diamonite Oxide throwaway insert turning tools, shoulder tools and facing tools, with positive, neutral or negative rake.

If you have not yet tried oxide cutting tools, or if results of your trials have not been up to expectations, you'll be pleasantly surprised when you try Diamonite Oxide throwaway inserts with the new Diamonite Superigid Tool Holder. If your tool supplier does not stock them, write for the name of the Diamonite representative nearest to you.

Why DIAMONITE OXIDE CUTTING TOOLS
MACHINE MUCH FASTER • GIVE LONGER TOOL LIFE • PRODUCE FINER FINISH

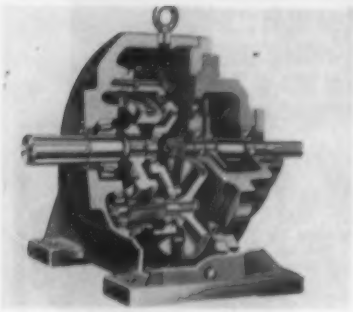
Structurally, a cutting tool consists of grains or crystals of hard, abrasive-resistant material supported by a bond capable of withstanding the various stresses to which it is subjected in service. The harder the grains or crystals and the stronger the bond, the greater the rate of material removal possible with the tool.

Diamonite is essentially sapphire substance in bond, developing a product next in hardness to the diamond. The crystals are specially-prepared, high-purity aluminum oxide, the same ultra-hard, highly abrasion-resistant material used so effectively in long-life, precision grinding wheels. The bond is non-metallic, vitreous — amazingly strong, highly resistant to heat and capable of developing strength at elevated temperatures far in excess of that attainable in metallic bonded materials.

- Being itself an oxide, Diamonite will not oxidize or "burn up" at high temperatures generated at ultra-high surface speeds.
- The Diamonite bond withstands both temperatures and pressures encountered under such conditions. Cracking or breaking due to poor bonding or varying co-efficients of expansion of dissimilar materials is eliminated.
- Being non-metallic, Diamonite will not weld to metals, causing tearing. Diamonite tools produce a fine finish approaching that of a ground surface.

A Diamonite tool supplier in your area will be pleased to work with you to help you enjoy maximum benefits from Diamonite Oxide tools on your equipment.

DIAMONITE products manufacturing company • Canton 2, Ohio



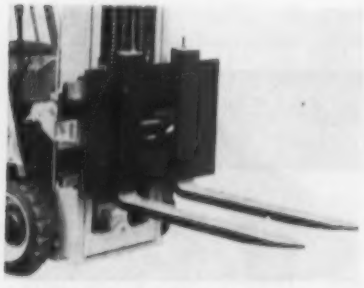
In-Line Speed Reducers Come In Eighteen Sizes

Line of helical speed reducers provides heavy-duty gear drives on such machines as conveyors and packaging installations. Eighteen sizes are available, in single, double, or triple reductions.

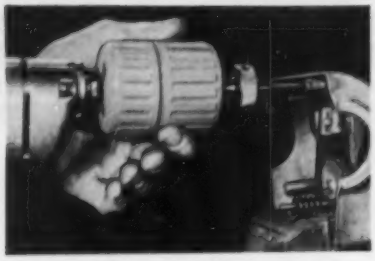
Construction features include crown-shaved and induction-hardened gearing, oversize thrust bearings, extra-heavy steel shafts, cast-iron housings, and two-way shaft seals to prevent oil leakage and protect against dust. Backstops can be furnished with the reducers, or installed in the field without further machining of housings.

Units are available in reduction ratios from 1.25:1 to 205:1, and in horsepower capacities from 1 to 110. Mountable in virtually any position, units may be directly coupled, or driven from chain or belt drives on driver or driven shafts, or both.

Philadelphia Gear Works, "G" St below Erie Ave, Philadelphia 34, Penna



SIDE-SHIFTER ATTACHMENT for company's stand-up and sit-down industrial trucks provides 8 in. of travel. Double-acting hydraulic cylinder moves forks 4 in. either side of center position. Full-length bronze wear plates replace anti-friction bearings, providing bearing surfaces along full length and adding only a fraction of an inch to the length. Design incorporates open center in fork carriage to aid operator's line of sight—*Lamson Mobilift Corp, Portland, Ore*



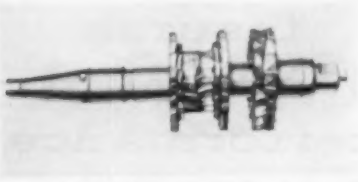
Supreme Tapping Attachment Attaches to Any Portable Drill

An instant-reversing speed-reduction unit made expressly for tapping, the Push-Pull tapper attaches to any portable drill. Speed reduction of 7:1 in the driving direction gives operator more than adequate power to tap in all materials. With instant reversing, direction of the tap can be reversed without stopping drill motor; thus operator can move tap into and out of the hole at will.

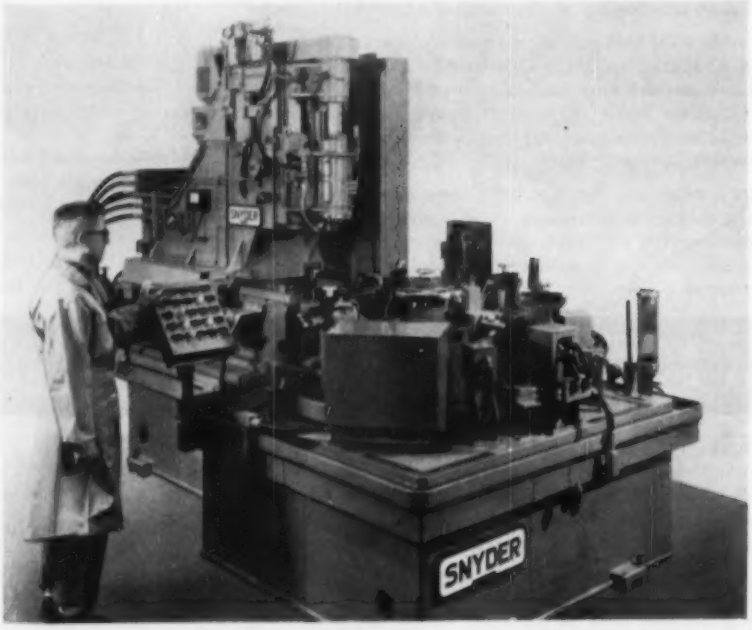
Tapper offers advantage of extra "feel" for operator. Housing of unit is held in the fingertips, and any unusual strain is felt instantly. Tap stops when the fingers are released, and runs in reverse when the rear housing of the tool is held.

Unit handles all taps up to 5/16 in., and the five necessary collets are included with the tool.

Supreme Products Corp, 2222 S Calumet Ave, Chicago 16, Ill



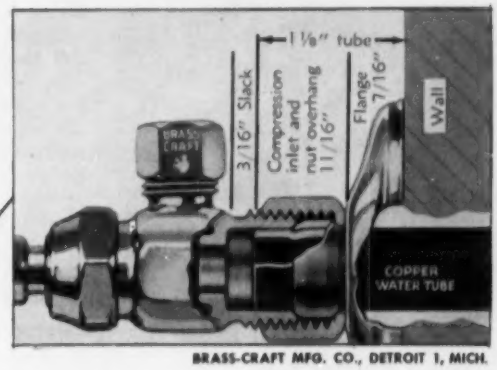
MULTIPLE MILLING CUTTERS for production milling combine a wide range of standard cutters in company's line. Side milling, slotting, straddle milling, or any combination of these can be performed in one operation. Company designs and manufactures units to suit unusual applications. All cutters incorporate company's curved-tooth design, said to provide a shearing action; corner of contact with work is eliminated—*Aber Engineering Works, Waterford, Wis*



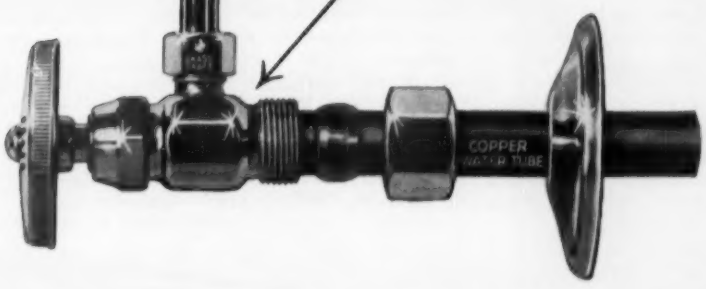
MAGNESIUM FRONT-BEARING SUPPORTS for jet-engine aircraft are machined on hydraulically operated, electrically controlled special milling machine, which mills bosses and performs four blend-milling operations. Unit consists of a T-shaped base on which are mounted a 40-in.-dia rotary table and a horizontal slide unit carrying a vertical spindle. Table speed, vertical cutter travel and horizontal slide travel are controlled by stops mounted on table periphery. Operations are performed with work in two different loading positions and using three milling cutters; all operations are performed in 50 min at 80% efficiency—*Snyder Tool & Engineering Co, 3400 E Lafayette, Detroit 7, Mich*

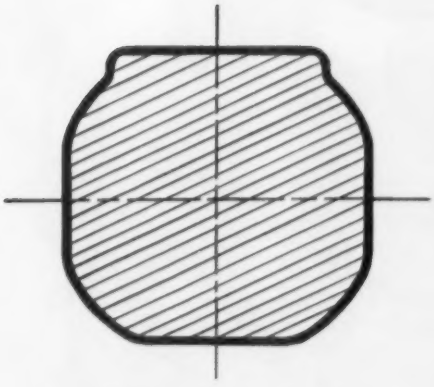
The **RIGHT** shape of
REVERE BRASS
enables BRASS-CRAFT to produce angle valves at minimum cost

At left is complete Speedway assembly as it is furnished to the Plumbing Trade by Brass-Craft. Revere also supplies the copper tube which, because of its fine grain structure, takes chrome plating to perfection.



BRASS-CRAFT MFG. CO., DETROIT 1, MICH.





Cross section of Revere Brass Shape used in fabricating angle valves. Corners are rounded for easy buffing, leaving sufficient surface area for wrench pad. Top is made flat for speedy insertion of outlet.

Brass-Craft Manufacturing Company, manufacturers of Speedway Supplies, Valves & Fittings, considered two factors in selecting the Brass Shape of its angle valves.

1. Fabrication from the standpoint of production.
2. Installation and performance of the valve in use.

The shape at the left was found to be "*right*" from a production standpoint. Brass-Craft preferred it because it was nearest to the finished shape, saving metal, as well as extra cutting and machining. The fine grain structure of Revere Brass makes it especially easy to cut, drill, thread, buff and plate. Its "*right*" shape permits fabricating the valves into assemblies which save installation time. In this way, Brass-Craft is able to produce a high-quality product at minimum cost.

In addition, these brass valves resist corrosion and are compatible with copper water tube. Thus they have ready acceptance with plumbing and building contractors, as well as home owners.

Once again it is proved that there is one "*right*" product for every application. A Revere T. A. (Technical Advisor) is available to help you get the one best for you. He is always ready to cooperate in seeking ways to save money and improve your product. Call or write today.

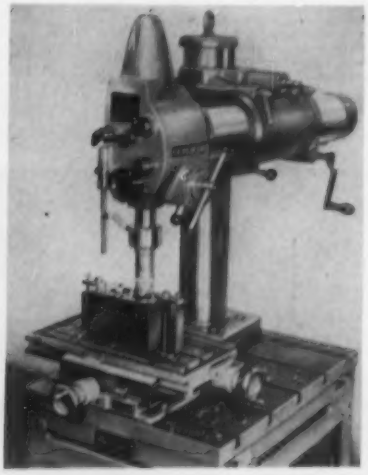
COPPER * BRASS * 18 01 REVERE ALUMINUM

REVERE COPPER & BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.



Swiss Precision Borer Has Swivel Arm and Head

Swiss-made Oerlikon UB2 precision borer combines a radial swivelling arm with a freely swivelling head, can perform such operations as milling, drilling, countersinking, tapping, counterboring, reaming, facing, and trepanning. Boring head can be canted to any angle and latched accurately into vertical and horizontal positions.

Boring spindle is reinforced by double-row roller bearing at the bottom of the quill. Range of speeds is from 30 to 3070 rpm, and 3 power feeds are combined with a compound table for coordinate locations. A variety of accessories is offered.

Imported by Olkon Research Corp, 630 Fifth Ave, New York 20, NY

Sparton Remote-Control System Can Position or Proportion Work

Designed to control remotely the position of operators for valves, gates, and loaders, remote-control system also can affect change in such quantities as speed, power, phase shift, power factor, pressure, and flow. System may be used in conjunction with existing operators or can be supplied complete with reversing motors and pilot operators up to several horsepower. It is also available with transducers for telemetering such functions as pressure, flow, position, or any electrical quantity. Visible and audible alarm, as well as fail-safe lock-out and hold-out features, can be added.

Bi-directional positioning is affected by polarized dc signals transmitted from a supervisory control panel to a remote slave receiver. Quantitative data on the controlled function is transmitted from the slave unit back to a meter on the supervisory panel. By moving a panel key, supervisor can actuate a remote operator in either "increase" or "decrease" direction, and simultaneously observe a change in the affected function. When desired quantity is reached, lever key is released and the change stops.

System features packaged building-block module construction, which can be installed by the average plant electrician. Over-all accuracy of the metering system is guaranteed to better than 2%.

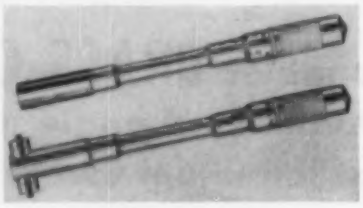
Sparton Control Systems Div, Sparks-Withington Co, Jackson, Mich

Flexaust Bendable Tubing Is Offered in Variety of Materials

Bendable tubing known as Plica has a three-ply wall and can be made in almost any desired combination of ferrous and non-ferrous metals, fiber paper, and other materials. Tubing, made by automatic machines in continuous lengths, has high wall strength, water tightness, and sharp bending radii.

Tubing can be used for such things as electrical conduits, coolant and lubrication lines, hot and cold air ducts, and flexible shaft casing. Size range is ⅜- through 2-in. OD. Bulletin 61.

Flexaust Co, 100 Park Ave, New York 17, N Y

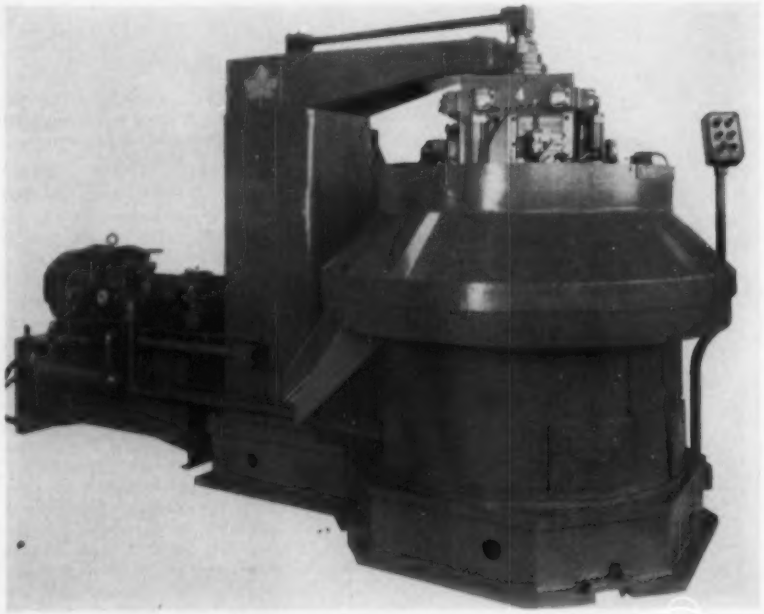


Rimat Micrometers Check Small-Diameter IDs

Identified as P and PX Series, small-diameter inside micrometers are offered in range between 0.310 and 1.250 in. Devices have gaging tips which are rectangular in cross-section, permitting rugged construction for checking very thin grooves and recesses.

P Series tools have tip widths of 1/16, 3/32, and 1/8 in. Tip widths of PX Series are 0.015, 0.025, and 0.035 in.

Rimat Gage Co, 21 W Dayton St, Pasadena, Calif



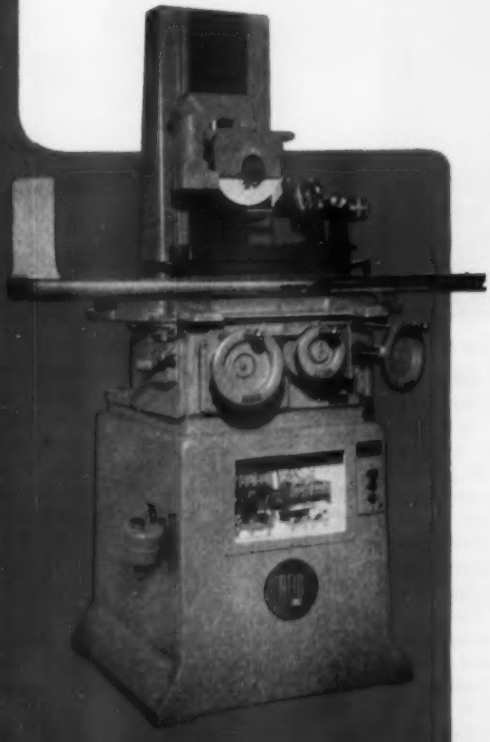
AUTOMOTIVE PISTON CASTINGS are rough-turned at a rate of one every 3 sec on special scalping machine, which is adaptable to piston sizes up to 5-in. dia and 5-in. length. Production is based on 4 vertically mounted work spindles located on a continuously rotating worktable; as table rotates, all movements are controlled by a hydraulic valve in machine's center column. Operator places casting on spindle, expanding chuck holds it, and it is scalped in two places at same time by cutters on hydraulically actuated tool slides— ***Standard-Modern Tool Co, Ltd, 373 Front St. E, Toronto, Canada***

PRECISION REID SURFACE GRINDERS

SETS THE STANDARD *for Precision* SURFACE GRINDERS

MODEL 824 Reid-O-Matic with push-button controls for fast selection of all grinding operations and quicker set-up and changes. Outstanding features, for production and toolroom grinding, include: finger-tip level controls, electrical components in single, sealed base housing for easy access, and adjustable gibs on head ways.

Specifications:
Capacity — 8″wide, 24″ long, 15″ high
Worktable — 66″ by 10¼″ overall
Table speed — infinite variation, 0 to 75 fpm.
Feed range — elevating mechanism, to .0005″; vernier, to .0001″
Spindle — 2 H.P., 1800 rpm. (std. cartridge type)



MODEL 618 — the standard for truly precise toolroom grinding. Features include: rugged construction with one-piece column, cogged timing belt for smooth table operation and sealed cartridge type motorized spindle for smooth chatter-free operation.

Specifications:
Capacity — 6″ wide, 18″ long, 17¼″ high
Worktable — 51″ by 8″ overall
Table speed — infinite variation, 12 to 35 fpm.
Feed range — elevating hand wheel-to .0005″; cross feed — to .001″
Spindle — 1 H.P., 3450 rpm.

For full details and specifications write for Bulletin 800

Reid Brothers Company, Inc.

BEVERLY MASSACHUSETTS

Haller Test Dies Check Powdered-Metal Bearings

Developed for briquetting tests on powdered-metal bearings, test dies are self-contained units. Core rods are secured to the die structure without increasing over-all length, and pins with hardened chromium-steel round dies are made to Metal Powder Assn standards for wall thickness.

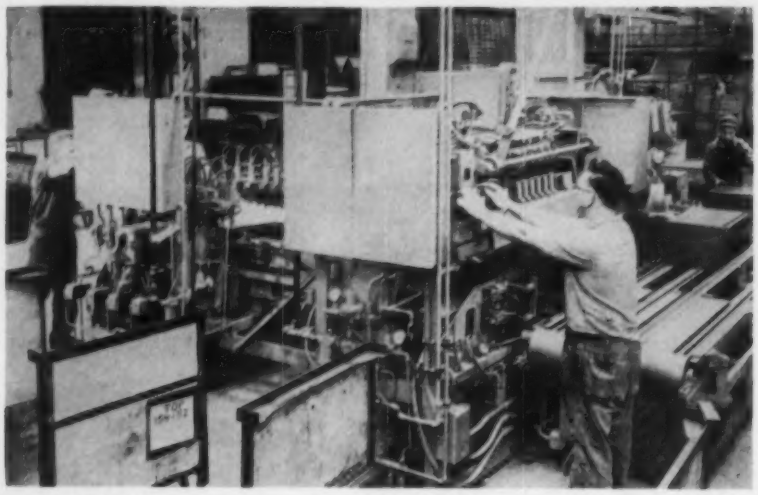
Lower member of unit contains spring retainer and guide-pin base for a floating action which produces the effect of top and bottom pressure in briquetting. Tools feature a continuously adjustable fill; lower punch can be raised or lowered to meet fill requirement. Maximum fill is normally 1 in., but longer fills are available.

In addition to dies for testing bearings, dies are also available for testing tensile bars, transverse-rupture specimens, and green-strength specimens, all offered in sizes according to current standards.

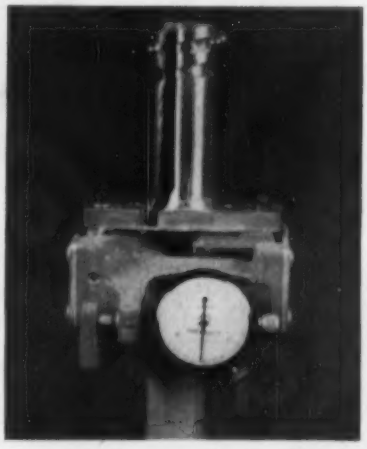
Haller, Inc, 684 Ann Arbor Rd, Plymouth, Mich

Power scraper, Type B, weighs only 6 lb, is all aluminum and steel. Cutter is Carboloy and is driven with a compound movement, reciprocating and also oscillating about its reciprocating axis, which produces a feather cut. Cutter operates at 1750 cuts per min, and stroke may be varied from 0 to ¾ in. Complete unit consists of tripod stand, motor, diamond wheel, flex shaft, cutter head, and one cutter.

R J A Scraper Sales & Service, 8405 Millis Rd, Utica, Mich



STEEL KITCHEN CABINETS are turned out every 9 sec on electronically controlled automatic welding machine, which has a production rate of 400 per hr. Special unit made for Toledo Desk & Fixture Co of Maumee, Ohio, consists of four automatic welding units interlocked by shuttles, timing controls, relay switches and circuit breakers. Operated by four men, machine eliminates hand-setting and hand-welding operations, will not weld until all cabinet parts are in perfect square — *Resistance Welding Corp, Bay City, Mich*

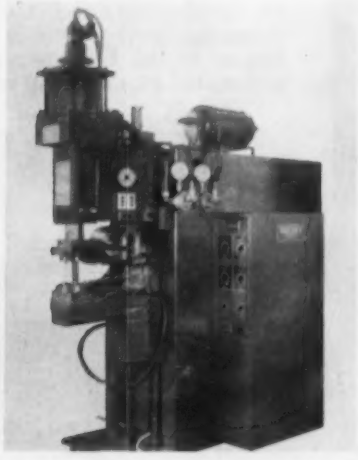


Bryant Instrument Checks Size Of Internally Threaded Ball Nuts

Internal ball-thread segments for checking the size of internally threaded circulating ball nuts are used with company's No. 21 portable thread gage. Each segment carries three balls located adjacent to each other in a helical groove corresponding to the pitch of the internal ball thread to be checked. Balls in opposite segments are 180° apart, giving direct reading of diameter and providing a quick centering action.

Circulating ball nuts checked are used in ball-bearing screw assemblies for such units as landing gears and power steering.

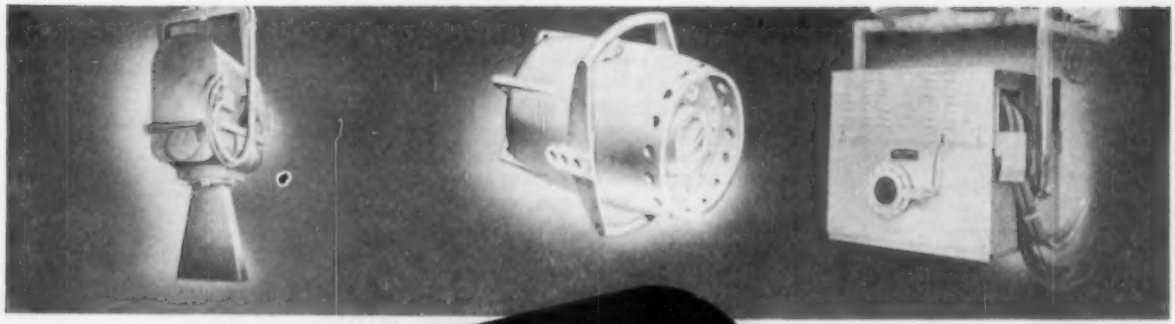
Bryant Chucking Grinder Co, Gage & Spindle Div, Box 690, Springfield, Vt



SPUD WELDING is accomplished with EPT-2 projection welder, which will weld ¾-in. spuds to 0.127-in. mild-steel tank shells or to heads. Lower arm is designed to clear tank shell of 12-in. minimum ID when welding fittings spaced 11 in. from bottom edge of shell. Projection throat depth is 18 in. —*Sciaky Bros, Inc, Dept APL-1, 4915 W 67th St, Chicago 38, Ill*

Wooden pallet boxes are wire-bound for strength and are offered in four sizes. Available in regular or open-front form (with or without gate), boxes can handle loads of 2000 to 3000 lb and are easily stacked.

General Box Co, 1825 Miner St, Des Plaines, Ill

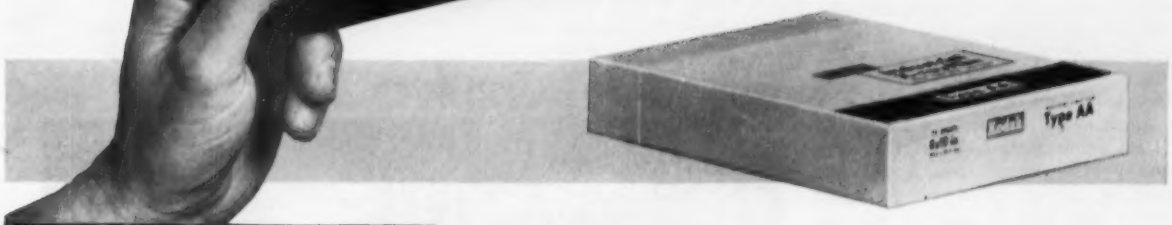


New Kodak X-ray Film

for

shorter exposures and quicker examinations

Kodak Industrial X-ray Film, Type AA



Read what the new Kodak Industrial X-ray Film, Type AA, will do for you.

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under shop conditions of use.

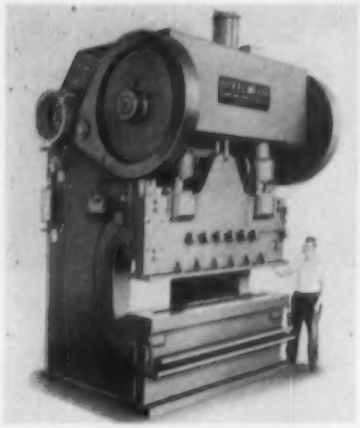
Here is a brand-new x-ray film that gives you greatly increased film speeds. It is a film that retains the fine sensitivity characteristics which have made Kodak Type A the most widely used x-ray film in industry. Then in addition it gives speeds up to more than double those of Type A.

This means that you can cut down exposure time, handle routine examinations more quickly.

Your x-ray dealer and the Kodak Technical Representative are ready to tell you all about this new film. Get in touch with them. See what it will mean to you.

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Kodak



Steelweld Brake Press Is Designed for Punching

Built to accommodate various punching arrangements, 400-ton brake press is provided with a double-plate bed which has a 3-in.-wide slot to receive punching slugs. Machine's bed is 8 ft 4 in. long and 17 in. wide. Press has a speed of 30 spm, but stroke length is only 2 in.; thus punch velocity is low and impact minimum, resulting in long punch life.

Clutch and brake are air-operated and designed so that inertia is very low, minimizing the energy to be absorbed. Disks are hollow at the center and provide passage for large volumes of cooling air. Unit working pressure on clutch and brake facings is also low.

Machine is designed to be placed 14 in. below floor level to provide a low working height; foot treadle extending across front of bed just above the floor is easy to operate. Top of bed is 28 in. above floor.

Control is provided by two-man operation. Before press can be set in motion, four buttons must be depressed.

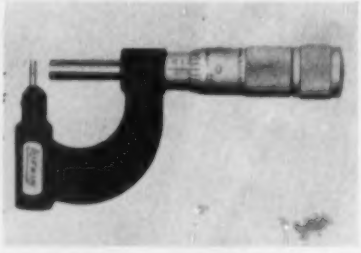
Steelweld Machinery Div, Cleveland Crane & Engineering Co, Wickliffe, Ohio

Magnetic Switch Monitors Assembly-Line Operations

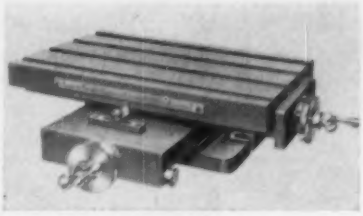
Operating on the proximity principle, magnetic switch locates objects containing iron on assembly lines and in liquids, and can be used to detect moving parts of automatic machine tools. Detection is accomplished by the object's passing through a magnetic field set up directly in front of the switch's sensing end; switch has no moving parts, and there is no physical contact with work. A signal flows through the magnetic circuitry of the switch and operates a remotely located electrical control relay, which can be triggered up to 10 times per second.

In assembly-line operations, switches program operations as metal parts move from one station to another. Any break in the sequence is immediately detected, and line is shut down until trouble is corrected. Switch is 6 in. long and 1⅝ in. square, and is sheathed in a steel housing. Magnetic circuitry is embedded in a solid plastic solution. Unit operates on 115-v, 60-c current, ranges in price from $85 to $145.

Minneapolis - Honeywell Regulator Co, Doelcam Div, 1400 Soldiers Field Rd, Boston, Mass



HOLE LOCATING AND TUBING MICROMETER has 0.089-in.-dia anvil that can enter a 3/32-in.-ID hole or slot. Range is 0 to 1 in. by 1000ths—*Lufkin Rule Co, Saginaw, Mich*



Cook Cross-Slide Table Is Lightweight Model

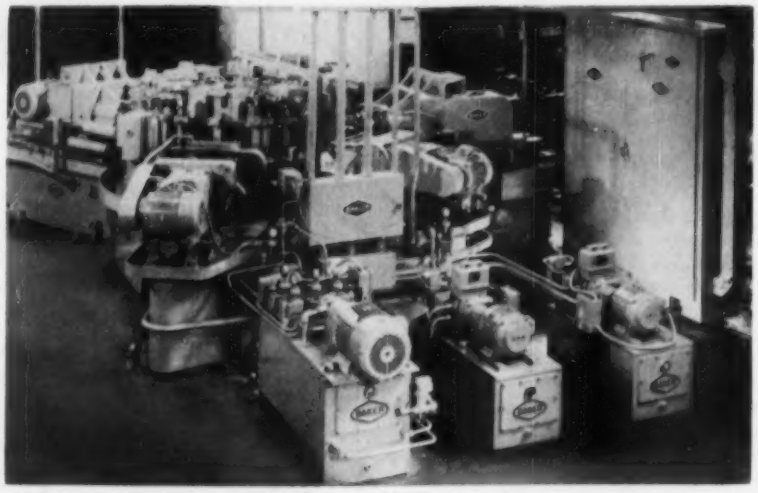
Precision cross-slide table fits all rotary tables, 12-in. or greater, for radii and angle milling on vertical milling machines. 8x12-in. table top has 4 T-slots with 6-in. scales on each slide. Dials are graduated from 0.001 to 0.050 in. per revolution. Leadscrews have hardened and ground threads.

Unit, made of high-grade cast iron, is 15 in. long, 4 in. high, and weighs only 65 lb. Ways and top are hand scraped.

Lawrence H Cook, Inc, Massasoit Ave, East Providence, R I

Pencil soldering iron weighs only 1 oz, has ⅛-in. tip, and is 7½ in. long. Thermostatic action controls heat, reportedly eliminating excessive fusing and tip burring. Tool operates on 110/120 v, ac or dc, comes with copper or special Walloy tip, and is also available in ¼-in. size.

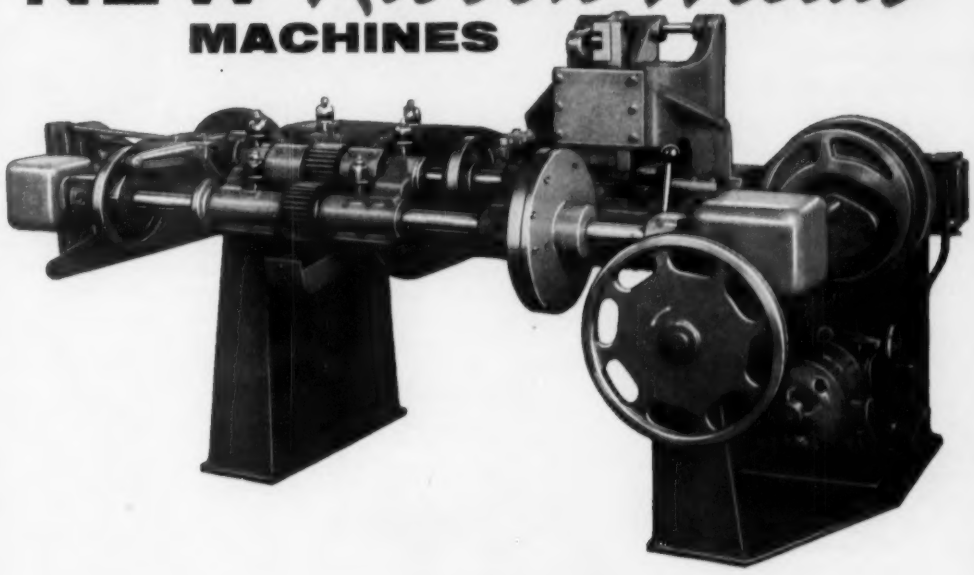
Wall Mfg Co, Grove City, Penna



JET NOZZLE BITS are finished on multiple-operation index-table machine; finished part functions as a bracket to hold a cutting head on an oil-well rock drill. 5-station unit operates to load two parts, center-drill, drill, counterbore, ream, and recess. Production rate is 123 per hr. Each fixture holds two parts, and identical operations on these parts are performed at every station. Machine is composed of standard machines which can be retooled for a variety of similar jobs — *Baker Bros, Inc, Toledo 10, Ohio*

...ask BAIRD about it

NEW *Ribbon Metal* MACHINES



Open UNEXPLORED opportunities for cost reduction in manufacture of a wide range of parts.

- HIGH SPEED
- UNIFORM PRODUCT
- LOW TOOLING COST
- EASY MAINTENANCE
- SIMPLE OPERATION
- UNLIMITED RANGE

If you are producing small . . . or even quite large . . . formed parts out of ribbon wire or metal strip up to about 2" wide, it will most certainly pay you to "ask Baird about it." More and more quality and cost-conscious manufacturers are finding that our NEW model Automatic High Speed Ribbon Metal Forming Machines are the ideal "production line" for such products.

Behind these machines are years of successful application to a range of work "limited only by the ingenuity of the men who design the tooling." NEW models include a host of important improvements and additional features which greatly extend the range of work and tooling possibilities. For example, what is essentially a substantial press is built right into the machine and is capable of maintaining precision in high-speed production. Baird's unique two-to-one feeding mechanism and EASY cam motions, combined with the fact that 3/4 of the cycle is available for forming rather than the usual 1/2-cycle, permits far greater latitude in combining operations and complexity of possible forms.

Our Engineering Department will be glad to give you further detailed information or to submit recommendations on parts or prints of your product. Write Dept. AM.

Interested in Deferred Payment? . . . "ask Baird about it."

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

7BA56

Benchmaster Coil Cradles Have Several Improvements

Series of Koil-Kradles, for handling coil stock up to 48 in. wide and 60 in. in diameter and in capacity ranges from 1200 lb to 16,000 lb, are capable of supplying and maintaining a slack loop from which any automatically-fed machine can draw. Pulling from slack weight instead of against the weight of a heavy coil makes for higher running speeds and for more accuracy with automatic feeding devices.

New actuating linkage, adjustable within a 90° arc and designed for use either inside or outside the slack loop, allows material to be fed normally over top of the cradle but also permits it to be fed directly from cradle to punchpress. Thus material can be supplied either curvature-up or curvature-down, depending upon die design.

Units are equipped with one or two guide plates by which stock is centered to the machine being fed. Single crank rotates three chain-driven leadscrews to position the guide plates.

Benchmaster Mfg Co, 1835 W Rosecrans, Gardena, Calif

CHAIN ADAPTER for use with King standard portable Brinell hardness tester in testing of large specimens is adjustable to size of piece to be handled. High-strength Chrome-moly steel arms hold chain to test head allowing head to remain rigid while chain takes full thrust of load—*King Tester Corp, 440-44 N 13th St, Philadelphia 23, Penna*

ROLLER STORAGE TABLE which houses 24-in. Zagar hydraulic drill heads is designed to simplify problems connected with intermittent multiple-hole drilling, where heads and tooling must be changed often. Any number of heads can be stored, each in its own loading basket on the roller table. Drill head in the machine is changed by dropping it on a loading basket, which then can be rolled by conveyor onto the table; new head is installed by reversing process—*Zagar, Inc, 24,000 Lakeland Blvd, Cleveland 23, Ohio*

Lexco Lift Tables Are Hydraulically Operated

Available with either hand- or foot-operated hydraulic unit, lift table is mounted on two 5-in. rigid casters and two 5-in. swivel casters. It is equipped with floor lock, controlled by foot pedal and toe release, to anchor it securely when in use. Table capacity is 2000 lb, and hydraulic unit has 3000-lb capacity.

Unit is available in sizes of 20 x 30 in., or 30 x 30 in. All tables have a 30-in. over-all height and an 18-in. rise to height of 48 in. Simple release valve provides fast or slow lowering.

Lexco Engineering & Mfg Corp, Dept HT, PO Box 161, Colmar, Penna

G E Rectifier Power Supply For Submerged-Arc Process

1540-amp recitfier power source, rated for 100% duty cycle for the submerged-arc process, is designed for operation on a 3-phase 460 or 575 v input (not reconnectable). Unit has an actual output range of 600 to 1600 amp, and can be operated continuously. It has a drooping volt-ampere characteristic, which limits the short-circuit current.

Input voltage is stepped down by a bank of three transformers of moving-coil design, then rectified by a bank of selenium rectifiers. Coils are motor driven to provide remote current adjustment. Controls for contactor and current output are mounted on unit's enclosure, and both can be operated remotely.

Entire unit is cooled by two fans powered by enclosed, reversible 1/3-hp motors. Coils, with Class H insulation, are rated for 130 C temperature rise. Open-circuit voltage is 78 v, and at full load output is rated 40 v.

General Electric Co, Welding Dept, Schenectady 5, NY

Dehumidifier called Mistkolector is a compact unit that captures smog and mist from machine tools using cutting oils. Unit is offered in two models and in four motor sizes, with volume ranging from 525 to 2685 cu ft per min, and motor hp from ½ to 5. Filter needs replacing only when suction loss is noted at the hood, or when vapor is discharging through the filter.

Hammond Machinery Builders, Inc, 1618 Douglas Ave, Kalamazoo, Mich

Caterpillar Tractor Co. Metallurgist T. H. Spencer inspects final drive pinion for D9 crawler tractor weighing 28 tons. Severe loading of this large pinion requires a steel with high case and core hardenability. Several years ago Caterpillar Tractor Co. found that simply by increasing the molybdenum content of AISI 8622 (to 0.30-0.40%), the desired properties were obtained at lower cost than was possible in any of the standard carburizing grades.

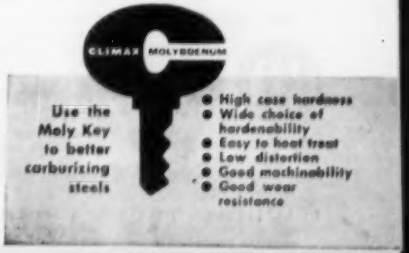
Caterpillar Tractor Co. improves case and core hardenability of carburizing steel by increasing molybdenum content

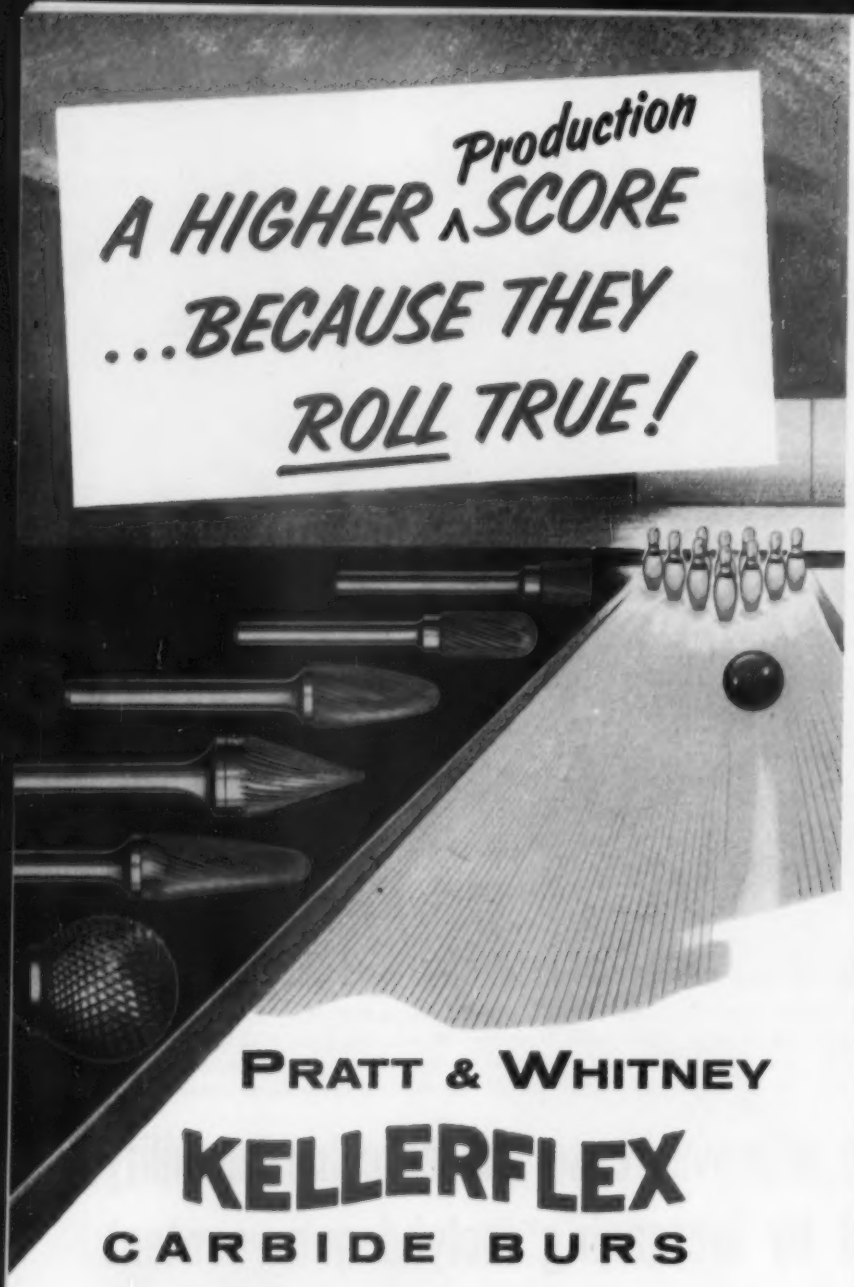
"Drive pinions in tractors must take very high torque loads," says T. H. Spencer, Metallurgist for Caterpillar Tractor Co. "AISI 8622 steel, which we had been using, couldn't give us the hard case and strong, tough core we needed in these heavy sections. Other standard carburizing steels with the requisite properties would have cost substantially more. We found, however, that we could achieve the desired surface and core properties by simply modifying AISI 8622 with a higher percentage of molybdenum. We have been using this composition for several years, and results have been excellent."

Caterpillar Tractor Co.'s experience shows how increasing molybdenum in a carburizing steel helped to solve a specific problem. Perhaps your product, too, can benefit by higher molybdenum content.

A technical article, "New Carburizing Steels for Critical Gearing", describes some recent investigations of higher-moly carburizing steels. For a reprint, write Climax Molybdenum Company, Dept. 12, 500 Fifth Avenue, New York 36, N. Y.

CLIMAX MOLYBDENUM





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KELLERFLEX

CARBIDE BURS

If you're looking for carbide burs that roll smoothly in the work . . . that cut faster and eliminate fracture-producing chatter and bounce . . . you'll find that P&W "Master Machine Ground" Carbide Burs are right down your alley! Exclusive machine grinding insures a concentricity and overall precision that *no* hand-ground bur can possibly match. That's why P&W Kellerflex Carbide Burs can help you roll up higher production scores.

YOU'LL FIND COMPLETE INFORMATION . . . on P&W Carbide Burs in Circular No. 564 . . . and you'll find that there are sizes, shapes and fluting types for every job requirement in the complete P&W Bur line. Send now for your free copy.

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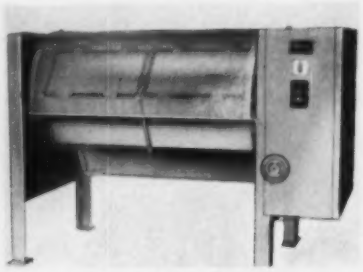
MACHINE TOOLS • GAGES • CUTTING TOOLS

NEW SHOP EQUIPMENT

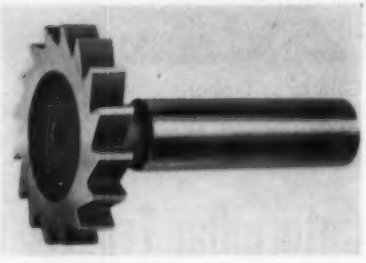


Model V-8 Barrel Finisher Has Improved Design Features

Motor of Model V-8 is now located at rear of machine for protection from water splash. Speed control handle is placed at front. Heavy wire mesh guard replaces solid sheet metal in front of barrels; this lifts up and back for easy access.

Unit has total capacity of 8 cu ft available in any interchangeable combination of 2, 4, 6, or 8-cu-ft barrels. Power is furnished by 1½-hp magnetic brake motor with jogging and reverse switch.

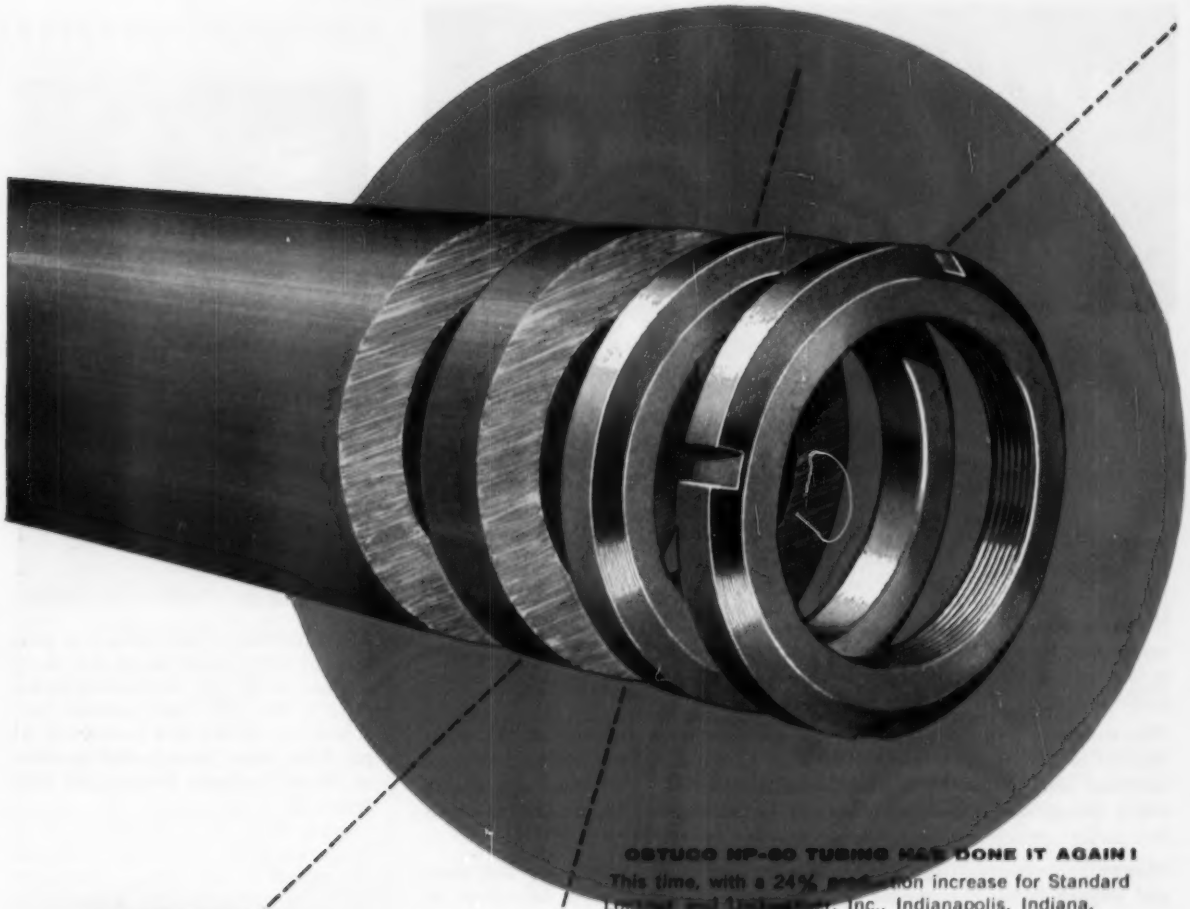
Rampe Manufacturing Co, 14915 Woodworth Ave, Cleveland 10, Ohio



KEYSEAT CUTTERS made of high-speed steel are available in 41 stock sizes, covering American Standard No. 202 through 1212. Cutters are all right-hand with ½-in. shank. Featuring a 5° positive rake angle, tools are precision ground and hardened by a special heat-treating process—*Fastcut Tool Co, 7405 E Davison, Detroit 12, Mich*

Solenoid and master air valves, used for three- and four-way operation, are available in sizes of ¼, ⅜, ½, ¾, and 1 in. Valves are used for controlling air cylinders and other air-operated devices. Bubble-tight aluminum spool is sealed positively by O-rings. Parts subject to wear are instantly replaceable. Flo-Line solenoid valves have built-in junction box for convenient piping of conduit. Bulletin 260.

Hanna Engineering Works, 1765 Elston Ave, Chicago 22, Ill



24% Production increase at Standard Locknut & Lockwasher, Inc. after switching to OSTUCO NP-60 tubing

OSTUCO NP-60 TUBING HAS DONE IT AGAIN!

This time, with a 24% production increase for Standard Locknut & Lockwasher, Inc., Indianapolis, Indiana. Tubing experts from OSTUCO recently recommended a switch to NP-60 Tubing specially processed for machineability for Standard's locknut and lockwasher line used in ball and roller bearing applications.

Standard components find their way into electric motors, machine tools, automotive, aircraft, farm and construction equipment. Other companies, with equally diverse applications, report similar success with NP-60. If you are machining bearings, washers, collars, or any circular part, you'll do well to check into the merits of OSTUCO's new NP-60 seamless steel tubing.

GET NP-60 WITH "SINGLE-SOURCE SERVICE."

New NP-60 seamless tubing comes to you with OSTUCO'S unique "Single-Source Service"—experience and facilities for design and development, production and delivery all under one roof. Get together with a tubing expert for preliminary planning on NP-60's possibilities in your product. Contact your nearest sales office or write direct to the factory.

OSTUCO SHELBY, OHIO

OSTUCO TUBING

SEAMLESS AND ELECTRIC RESISTANCE WELDED STEEL TUBING—Fabricating and Forging

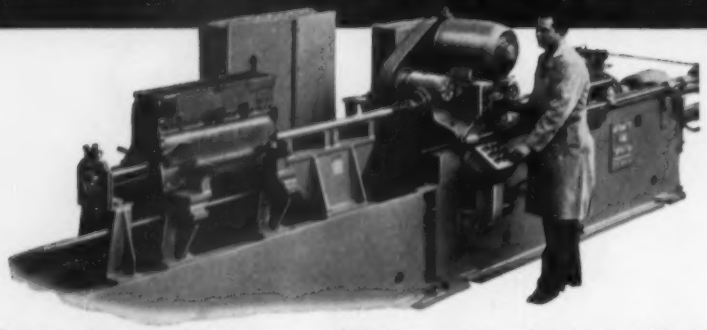
OHIO SEAMLESS TUBE DIVISION
of Copperweld Steel Company • **SHELBY, OHIO**
Birthplace of the Seamless Steel Tube Industry in America

SALES OFFICES: BIRMINGHAM • CHARLOTTE • CHICAGO (Oak Park) CLEVELAND • DAYTON • DENVER • DETROIT (Ferndale) HOUSTON • LOS ANGELES (Beverly Hills) • MOLINE NEW YORK • NORTH KANSAS CITY • PHILADELPHIA PITTSBURGH • RICHMOND • ROCHESTER • ST. LOUIS ST. PAUL • SALT LAKE CITY • SEATTLE • TULSA • WICHITA

CANADA, RAILWAY & POWER ENGR. CORP., LTD.

EXPORT: COPPERWELD STEEL INTERNATIONAL COMPANY 225 Broadway, New York 7, New York

WHY CUMMINS main bearings are MICROHONED

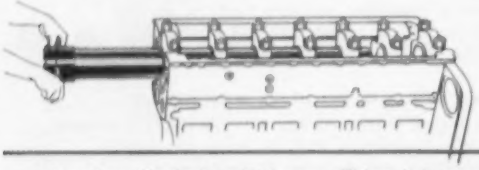


"Cummins diesel engines have a world-wide reputation for dependable, low-cost power. Here at Cummins, we attribute the wide acceptance of our engines to constant searching for better processing methods and improved engine performance.

"For example, if our crankshaft main bearings were undercut at the ends, tapered or out-of-round, then the full load of the journals would be borne by relatively small areas. This would cause bearing inserts to overheat and quickly break down. Also, should the bearings be misaligned, the crankshaft would flex during rotation and cause fatigue failure.

"However, by Microhoning our main bearings we secure *round, accurately-sized* and *aligned bores*. Cummins is the first diesel manufacturer to Microhone its main bearings. The surfaces of Microhoned bearings are clean-cut, free of deformed metal and the finish is consistent in every bore. In addition, the consistent accuracy generated by Microhoning permits us to make faster set-ups and use higher cutting feeds on preceding boring operations—Microhoning automatically corrects all inaccuracies.

"After Microhoning, all main bearing bores are checked with a gage plug 44 inches long and .0007 inch under required bore size. Gage must have a simultaneous slip-fit through all bores in the block. Tolerance for roundness is less than .0002 inch and finish is held to the specified 55 microinches."



Learn how Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME _____

TITLE _____

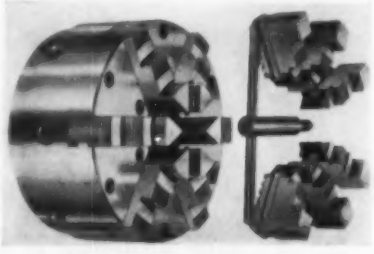
COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

AIR-POWERED CHAIN BLOCK is capable of lifting loads up to 900 lb at a speed of 36 fpm. Designated Model MT-504, the 55-lb hoist operates from a half-inch air line at a pressure of 85 psi. Hoist draws 1.6 cu ft of air per foot of lift—*Atlas Copco Eastern, Inc, Paterson, NJ*



AJUST-TRU CHUCKS, 3 and 6-jaw models, are available in 8, 10, and 12-in.-dia models. Features include adjustment to dead true within a minute; guaranteed precision within 0.0005 in. chucking duplicate pieces; automatic take-up for wear—*Buck Tool Co, 2015 Schippers Lane, Kalamazoo, Mich*

High-vacuum rotary pump featuring air cooling is designed as a continuous-duty unit capable of producing vacuums of 29.9-in. Hg when referred to a 30-in. barometer. Air capacity is 14 to 40.8 cfm, operating temperature is 140 F. Lubricating system is also air-cooled. Pump comes in two sizes with various vacuum ratings.

Leiman Bros, Inc, 146-181 Christie St, Newark 5, NJ

VERTICAL SOLID SHAFT MOTOR, Uniclosed Type HV, is now available from 1 to 10 hp, will soon be furnished up to 30 hp. Units are supplied with NEMA style C or P base. Vertical shaft connection for directly applied power simplifies hookup, unitizes motor with driven machine—*US Electrical Motors Inc, Box 2058 Terminal Annex, Los Angeles 54, Calif*

Anti-rust compound, water-soluble NoRuSol, can be applied either by spraying or dipping parts in a 3% solution heated to 130 F. Protective film can be left on work for most subsequent operations, or easily removed with mild cleaning solution. Protected parts can reportedly be stored indoors for 30 days under normal plant conditions.

International Chemical Co, Dept 124, 2628 N Mascher St, Philadelphia 33, Penna

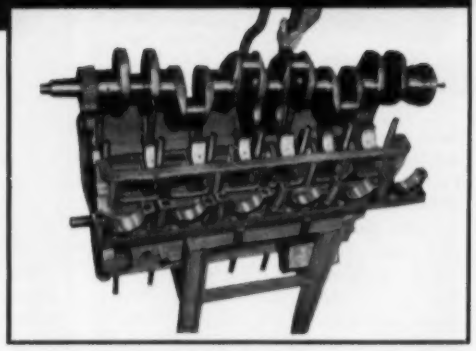
Transmission belt for very high speed drives is called Rusco Ultra-Speed. According to maker, spindle speeds in excess of 100,000 rpm can be maintained for extended periods over small pulleys without apparent damage to belt in an oily atmosphere at elevated temperatures. Belt is a special blend of synthetic and natural fibers bound together in such a way that it is said to be free from fraying.

Russell Mfg Co, 67 E Main St, Middletown, Conn

Bias cloth buff, of "centerless" construction, features cloth gripped by special steel rings, so that center is open. This construction permits cooler running, increasing production and lengthening buff life. Buffing head can be changed in seconds.

American Buff Co, 2414 S LaSalle St, Chicago 16, Ill

HOW MICROHONING generates round, accurate, aligned bearing bores



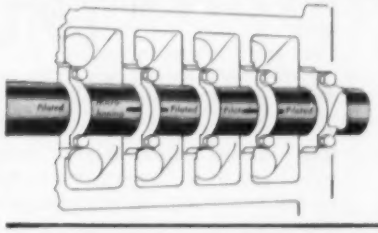
All types of cylindrical surfaces, including small diameters and combinations of soft and hard metals . . . interrupted by keyways, undercuts, ports, reliefs or cross holes . . . can be economically Microhoned to precision tolerances and alignment.

A typical example of Microhoning interrupted cylindrical surfaces is the Cummins Diesel Engine application. Here's how Microhoning generates accuracy and alignment in the crankshaft main bearing bores:

1. Cutting pressure is applied radially from the center of the Microhoning tool body. Abrasives and guides both are expanded by the same feed force, and wear at the same rate.

2. Abrading action is divorced from the effects of spindle or driveshaft vibration and misalignment by a universal joint that is between tool body and driveshaft.

3. The single bank of abrasives travels through all bores on every stroke. As abrasives are Microhoning one bore, the tool is piloted by the plastic guides in the other bores.



The principles and applications of Microhoning are thoroughly explained in a 16mm, 30-minute sound movie, "Progress in Precision". We'll be glad to reserve a print for your use.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).

☐ Please send Microhoning literature; I am interested in the following application _____

NAME _____

TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ____ STATE _____

MICROMATIC HONE CORP.

8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

Sam Made The PANTS TOO LONG

PRESIDENT, THE CINCINNATI GEAR CO.

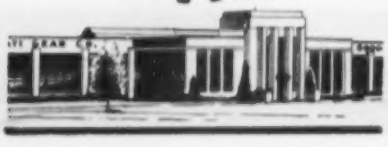
Some time ago I had a friend who decided (as I guess everyone has at some time) that the best way to get a good suit would be to buy some cloth that he particularly liked and then have the suit "made to measure" by a tailor. The purchase of the cloth presented no problem, but the selection of a tailor was another matter. He finally chose a small, inconspicuous one-man shop someone suggested to him; the poor fellow who ran it looked half starved, so he assumed he was about to get a real bargain.

After a reasonable wait, he got the suit; but it was a *terrible* fit. He went back for "alterations." It still fit poorly, but he didn't have the heart to go back again to the old man and tell him the truth — that his suit was no good. So, he gave the suit to his yard man.

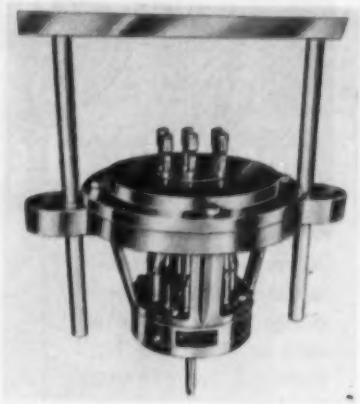
The moral of this is clear — unless you're a gambler by nature, take your business to a shop that is big enough to do the job right in the first place, or to *make good* if it turns out wrong. This moral holds true whether you're buying suits or custom gears. Our reputation of nearly 50 years of virtually invariable customer satisfaction shows that we are equipped to do the job *right* — and if, by some chance, there *is* something wrong, we correct it to your complete satisfaction — almost quicker than you can say "Sam, you made the pants too long!"

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
"Gears—Good Gears Only"

CINTI®



NEW SHOP EQUIPMENT



SPINDLE LOCATOR PLATE converts adjustable universal-joint head to a controlled jig-bored fixed-center head. Locator plate can be adapted to company's ¼, ½, and 29/32-in.-capacity universal drilling and tapping heads. Units are made of sand-cast aluminum, turned all over and jig bored to customer's needs and bushed—*Errington Mechanical Laboratory, Inc, Staten Island 4, NY*

Carbide inserts added to line of laboratory-grade cemented carbides are offered as standard triangular and square throwaways and styles P and H inserts. Triangular units are stocked in both utility and precision-ground grades, are available in six sizes and three grades. Square inserts are carried in four sizes ranging from ⅜ x ⅛ in. to ¾ x 3/16 in. Styles P and H inserts are ground ready for use, are stocked in nine sizes and five grades. Catalog 2.
Firth-Loach Metals, Inc, Buttermilk Hollow Rd, McKeesport, Penna

Hole former called Barrel Buddy cuts clean, non-jagged holes in barrel with only slight pressure on handle. Chain hoist hooks can then be attached to move barrel. Forged-steel cutting head of tool is placed against barrel with jaw or rim. To make hole, tool is pulled down. Price is $9.95.
Huron Steel Treating Co 12611 Haggerty Rd, Belleville, Mich

Alkaline burnishing compound designated FM 186 is intended for use with zinc die castings. Said to produce a brighter finish and to improve color, liquid compound is also recommended for burnishing steel and copper and its alloys.
Oakite Products, Inc, 18½ Rector St, New York 6, NY

New "Series 333" Drills for Drilling Cast Iron!

ACE
CARBIDE DRILLS

Whatever your carbide drill requirements may be . . . whether solid carbide or carbide tipped . . . it always pays to make sure you use an "ACE". Their "ground-from-the-solid", highly polished flutes have keener, stronger cutting edges. And that means finer accuracy, longer tool life, and lower drilling costs for you!

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL
ADRIAN, MICHIGAN
ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

AUTOMATION?
you name it...we'll tape it!

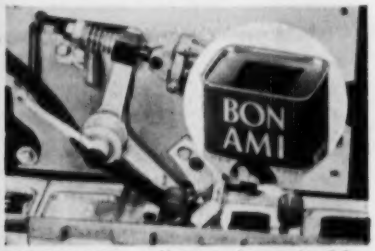
The trend in industrial production is toward *automation* . . . and tape application is no exception. There are more than 75 different types of manual, semi-automatic, and automatic dispensers for "SCOTCH" Brand Tapes. These basic types lend themselves to an infinite variety of adaptations. Chances are, wherever you use (or *could* use) tapes, we can provide a dispenser that will enable you to enjoy cost-saving, production-speeding benefits.

PRODUCT OF 3M RESEARCH **DISPENSERS**... *to speed the application of the more than 300 pressure-sensitive tapes for industry, trademarked . . .*

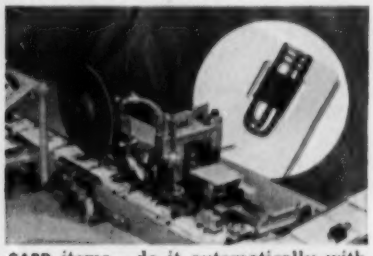
REG. U.S. PAT. OFF.

SCOTCH
BRAND

Look what you can do with dispensers!



FLAT-SURFACE applicator, dramatized by Artzybasheff at left, automatically applies predetermined lengths of tape to moving objects at production-line speeds of better than a unit a second.



CARD items – do it automatically with "SCOTCH" Brand Tape. Here, tubes and pre-printed cards are brought into position in "tape stapler"; printed, transparent, or colored tape automatically locks tube and card together.

COMBINE two or more same-size packages automatically with "SCOTCH" Brand Tape and "SCOTCH" Package Bundler S-69. Handles up to 75 combinations a minute; special cut-off synchronizer available for printed tapes.

SEND FOR free folder describing automatic, semi-automatic, and manual "SCOTCH" Brand Dispensers for production, packaging, and assembly. Write on your letterhead to 3M Co., Dept. MA-106.

The term "SCOTCH" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario.

© 3M Co., 1956

NO PART THE SAME SIZE OR SHAPE, YET . . .

ONE DeVILBISS AUTOMATIC PAINTS THEM ALL!

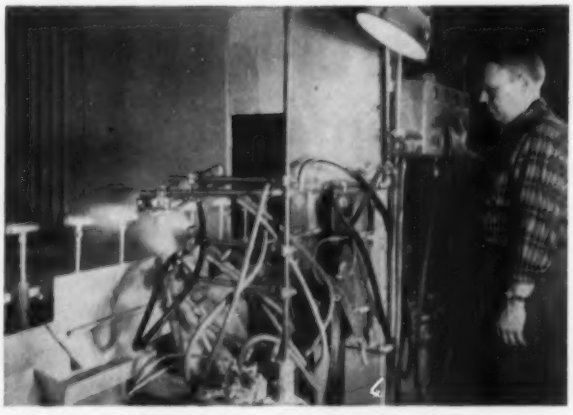
At NuTone, Inc., Cincinnati, Ohio, large-scale production of the new NuTone Mixer-Blender – in glistening two-tone baked enamel – demonstrates the flexibility and efficiency of DeVilbiss automatic finishing equipment.

Averaging 1,000 parts of varying sizes and shapes per hour, one DeVilbiss automatic machine spray-applies one-coat finishes with flow-out and coverage rivaling most two- and three-coat jobs!

An ingenious automatic control device actuates only those guns, from a battery of four, needed to provide complete coverage as different parts pass the spray station. Spit-second timing of the guns, and synchronized rotation of the parts ensure uniform film build on all surfaces – despite undercuts, deep recesses, and complex contours.

Over-all results: high production at remarkably low cost, consistently high-quality finishes, negligible number of rejects.

For full information about DeVilbiss automatic spray equipment, call your nearby representative. He'll provide you with many time- and cost-saving suggestions for your finishing operations.



All painting of NuTone Mixer-Blender components is performed at this spray station. The automatic guns are served by a DeVilbiss paint heater, located on the side of the spray booth.

THE DeVILBISS COMPANY
Toledo 1, Ohio
Santa Clara, Calif. • Barrie, Ontario
London, England
Branch Offices in Principal Cities

FOR BETTER SERVICE, BUY
DeVILBISS

Stone Cutoff Machine Equipped For Automatic Production Work

Model M-75 cutoff machine, designed for cutting ferrous metals, is equipped with automatic barstock feed and power-stroked head, so that automatic production-line work is possible. Speeds of 550 cuts per hr are maintained, with tolerances held to less than 0.005 in.

Machine has a wheel-wear compensator which adjusts for fast approach and regulated speed of cutting operation by hydro check. Cutting head is engineered with geared-in-head positive drive.

Stone Machinery Co, Manlius, N Y

Plastic ear plugs called Saf-Ears permit normal operations by personnel through reduction of dangerous sound intensities. Company reports that use of devices has produced noise attenuations up to 45 decibels. Two types of materials are used in the plugs, one for reduction of certain low frequencies, another for low and middle frequencies.

Hartford Ear & Acoustic Laboratories, 190 Trumbull St, Hartford, Conn.

Continuous-threaded steel rod can be bent cold, is available in a wide range of diameters and a number of lengths. Product is made of No. 1010 cold-drawn steel by a special cold-rolled threading process said to produce uniform threads to close tolerances.

Claude Sintz, Inc, 1940 Stanley Ave, Detroit 8, Mich

Short-shank stub taps for screw machines are available in regular sizes from No. 0 through No. 14 and from ¼ through 1 in. Taps, which are shorter than previous taps offered by company, are said to eliminate need for cutting and altering to fit. Taps fit standard bushings.

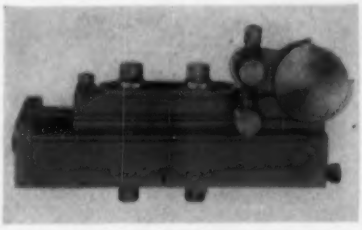
Besly-Welles Corp, Dept AM, 110 S Dearborn Ave, South Beloit, Ill

Extension tape rule, called Rulo-Matic, permits readings from a dial built into top of case containing it. Measurements can be read from a vernier dial showing 1/16-in. fractions. Furnished in a chromeplated case, rule incorporates serrated-steel wheel scriber for marking. Cost is $3.25.

Frederick Post Co, 3650 N Avondale Ave, Chicago 18, Ill

Self-locking insert called Nylock is available optionally on company's line of socket head screws and aircraft bolts. Device is incorporated in male threaded fasteners of all types, including standard and special products, and consists of nylon pellet inserted in a hole drilled part way through threaded portion of bolt. When bolt is installed in hole or nut, exposed portion of pellet is compressed between mating threads, forcing them together under pressure.

Standard Pressed Steel Co, Jenkintown, Penna



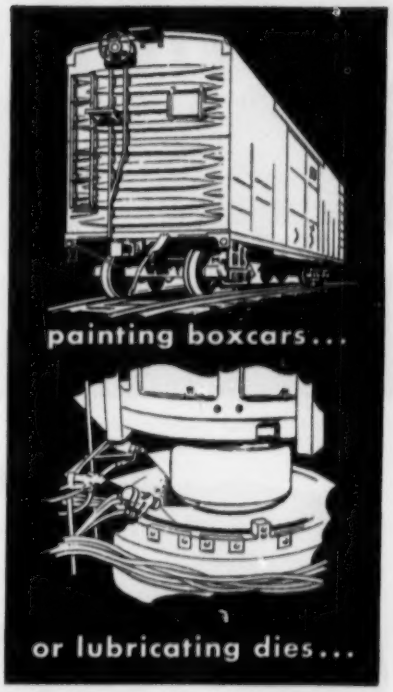
CROSS-SLIDE TOOLHOLDER for multi-spindle automatics can be used in either front or rear cross-slide. Made for circular tools, holder is designed to operate within capacity of the machine—*R & L Tools, 1825 Bristol St, Philadelphia 40, Penna*

Combined drills and countersinks are made in high-speed steel in plain type, No. 1 through 8, and in bell type, No. 11 through 18. Old letter sizes, plain and bell type A-1 through N-2, are also carried in stock. Dimensions of all standard sizes conform to industry standards. Included countersink angle is 60°.

Fastcut Tool Co, 7405 E Davison, Detroit 12, Mich

Nylon grommets, supplied in ten-in. strips or cut to specifications, can be snapped into place where needed. Strips follow the contour of any shape, providing electrical insulation or mechanical protection of metal edges.

Nylon Molding Corp, 141 South Ave, Garwood, NJ

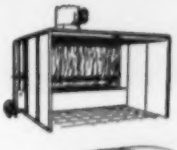


DEVILBISS ANSWERS ALL COATING NEEDS

DeVilbiss has the industry's most complete line of spray equipment and accessories . . . for fast, efficient, low-cost application of anything that pours — paints, drawing compounds, adhesives, catalyst materials and similar liquids. Write for data.

DeVilbiss spray guns are precision built for finest performance. High-speed, manual or automatic service.

DeVilbiss air compressors deliver up to 22.6% more air per power dollar than most others. Stationary and portable models. ½ through 15 hp.



DeVilbiss spray booths come in a complete range of standardized types, sizes—fireproof, reinforced steel panel construction.

DeVilbiss hose is specially fabricated for longer service; is solvent resistant.

THE DEVILBISS COMPANY
Toledo 1, Ohio

Santa Clara, Calif.
Barrie, Ontario
London, England

DEVILBISS

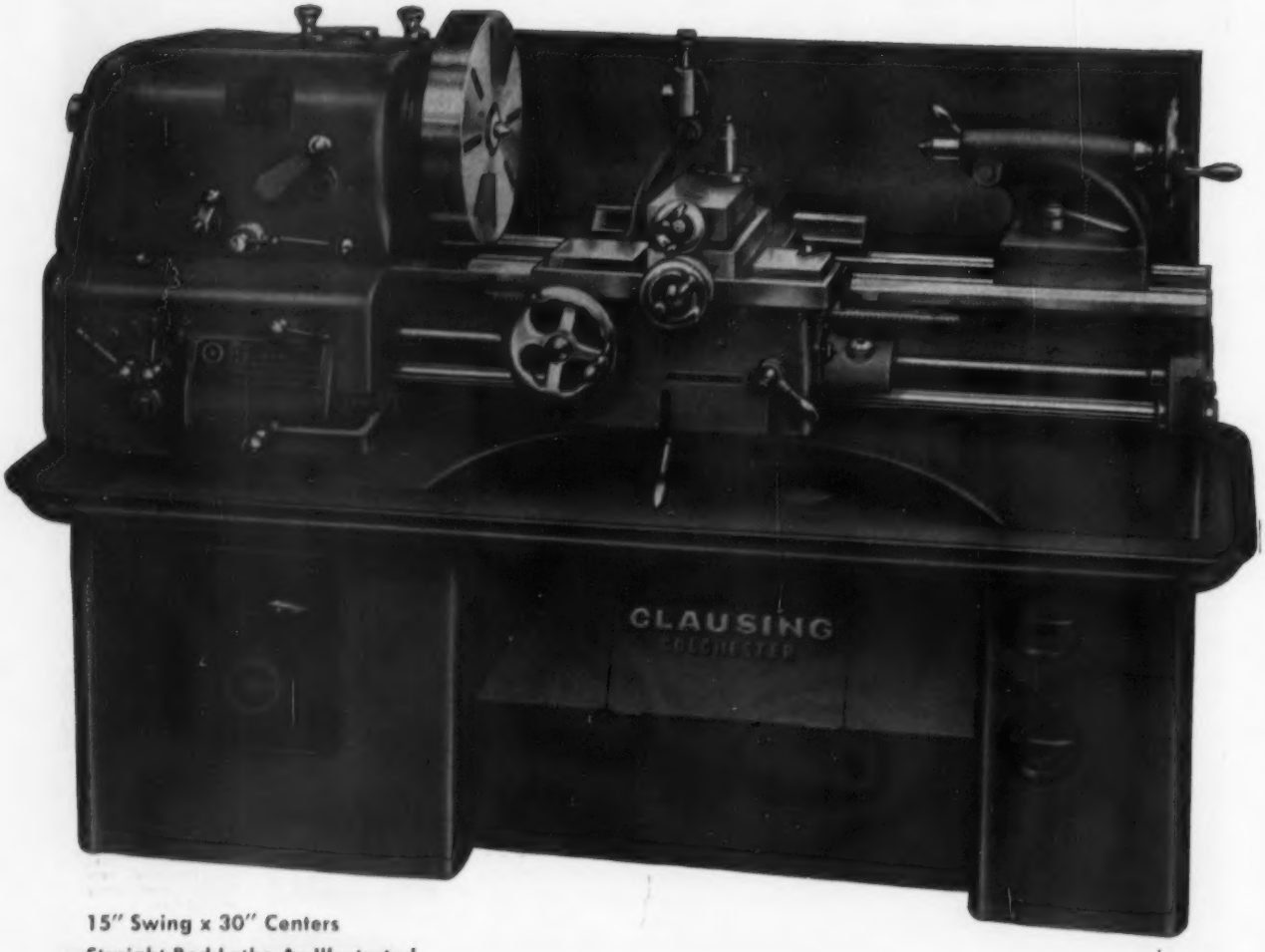
Branch Offices in Principal Cities

CLAUSING-COLCHESTER

13" - 15" - 17"

GEARED-HEAD PRECISION LATHES

BUILT TO AMERICAN TOOLROOM LATHE STANDARDS OF ACCURACY



15" Swing x 30" Centers
Straight Bed Lathe As Illustrated,
with Motor and Controls $2650
f.o.b. Nearest Port of Entry

NEWEST ADDITION TO THE

CLAUSING PLUS VALUE LINE

LATHES · DRILL PRESSES · VERTICAL MILLERS

OUTSTANDING QUALITY AND VALUE

See how much MORE you get with . . .

CLAUSING-COLCHESTER

GEARED-HEAD PRECISION LATHES

BIG CAPACITY — larger spindle capacities (see chart in panel to the right). Swing for the gap bed models is 29″ for the 17″; 25″ for the 15″; and 19″ for the 13″. Between centers capacities: 78″ for the 17″ lathe; 30″ and 48″ for the 15″; and 24″ and 36″ for the 13″. Geared-head drive powered by multiple V-belts.

HEAVY-DUTY CONSTRUCTION — Massive semi-steel beds with elliptical cross ribbing. Precision-ground V and flat ways — hardened ways available. Geared-head and quick-change box run in bath of oil, all gears shaved and hardened. Power feeds taken from separate feed rod, lead screw used only for screw cutting. Note size of spindles and spindle bearings (see chart in panel at right). Note, too, the heavy-duty construction of tailstock, and of carriage assembly with double-walled apron.

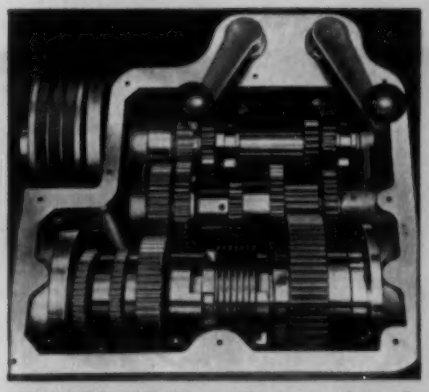
PRECISION PERFORMANCE — built to American toolroom lathe standards of accuracy. Have GAMET MICRON tapered roller bearings . . . with oil flow lubrication . . . most advanced and accurate bearings known to industry.

PROMPT DELIVERIES — through your authorized CLAUSING-COLCHESTER dealer.

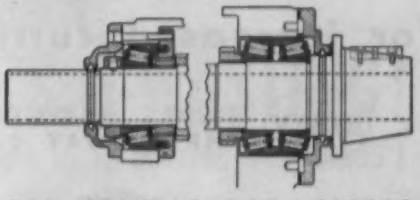
OUTSTANDING QUALITY and VALUE — built by Europe's largest manufacturer of precision lathes . . . for over 50 years producers of lathes acknowledged the world over to be the finest value and the most accurate in their class! Backed by the coast-to-coast sales and service organization of one of America's leading machine tool manufacturers . . . CLAUSING.

PRICES — 13″ cabinet base models, including motor and controls start at $1875; 15″ cabinet base at $2650; 17″ at $4200. All f.o.b., nearest port of entry. 5 straight bed and 5 gap bed models available.

WRITE FOR ILLUSTRATED LITERATURE



GEARED-HEAD — all gears shaved, heat-treated, high-tensile steel. Completely enclosed. Continuous bath of oil to entire mechanism. Quick-change box cast integrally with bed for maximum strength. Heat-treated, shaved gears carried on high-tensile, heat-treated spline shafts turning on phosphor bronze bearings.



BIG SPINDLE CAPACITIES

CAPACITY	17″	15″	13″
THRU-HOLE	3-1/16″	2-1/16″	1-9/16″
NOSE TAPER KEY DRIVE	L-2	L-1	L-0

BIGGER BEARINGS

GAMET MICRON precision taper roller bearings with oil flow lubrication . . . the most advanced and accurate bearings known to industry.

SIZE	17″	15″	13″
FRONT SPINDLE BEARING O.D.	7½″	5⅛″	4″

BUILT IN EUROPE'S LARGEST LATHE MANUFACTURING PLANT

—BACKED, SOLD AND SERVICED BY—

CLAUSING DIVISION
ATLAS PRESS COMPANY

10-101 N. PITCHER ST. • KALAMAZOO, MICHIGAN

NEW

BESLY

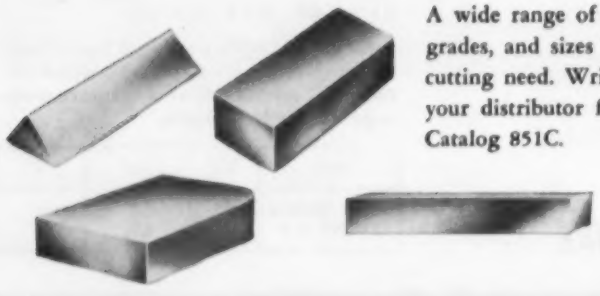
CARBIDE TOOLS

for increased cutting efficiency

BESLY TOOL HOLDERS and THROWAWAY CARBIDE INSERTS

A *complete* line of holders and triangular or square throwaway carbide inserts. Write, or ask your distributor for Catalog 852C.

BESLY CARBIDE BLANKS



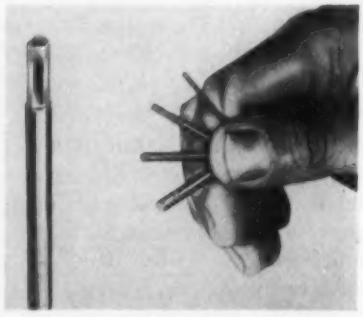
A wide range of styles, grades, and sizes for every cutting need. Write, or ask your distributor for Catalog 851C.

BESLY-WELLES CORPORATION
Est. as Chas. H. Besly & Co., 1875
120 Dearborn Avenue
South Beloit, Illinois

NEW SHOP EQUIPMENT

Variable transformers in Adjust-A-Volt line are available in nine motorized models and in single or up to 6-ganged assemblies. With range from 0.35 to 38 kva at 115 or 230 v, units are designed for applications where it is desirable to operate variable transformers remotely by push-button or switch. Four standard speeds of 6, 13, 26, and 45 sec for full-range travel are available on each model.

Standard Electrical Products Co, 2240 E Third St, Dayton 3, Ohio



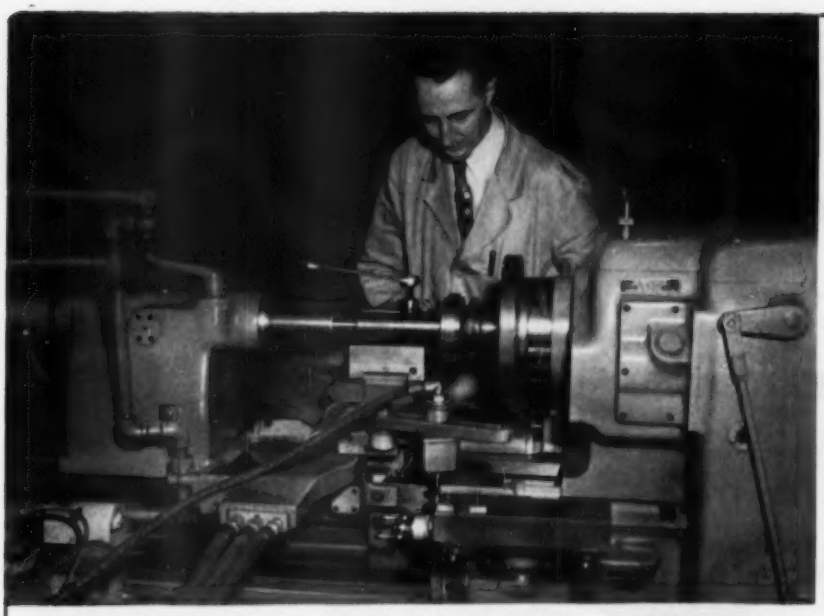
STRIKE BROACHES are designed to produce hex sockets in set or cap screws. Made of heat-treated HSS, units are ground to a tolerance of 0.0005 in. across flats. They are available as standard tools and are made for set screw sizes from No. 0 to ¼ in.—*Woodruff & Stokes Co, 349 Lincoln St, Hingham, Mass*

Copper-zirconium alloy possessing high electrical conductivity and good strength retention at elevated temperatures is suitable for electric-motor commutators serving at temperatures above 500 F. Electrical conductivity of alloy is 95.8% that of the copper standard. Machinability of alloy, which contains 0.25% zirconium, is reported good.

Battelle Institute, 505 King Ave, Columbus 1, Ohio

Load cycle counter with telemetering feature will count only work or operations actually performed. Device differentiates between idling, dry runs, and load cycle, counting only the latter. It is actuated by sensing the current flow to electrically driven machines. Telemetering feature permits simultaneous counting at the machine and at a remote location. Counter is available with 6-digit counter; speeds up to 100 counts per min are reported possible.

Ram Meter, Inc, 1100 Hilton Rd, Ferndale, Detroit 20, Mich

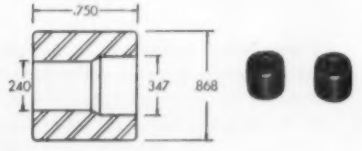


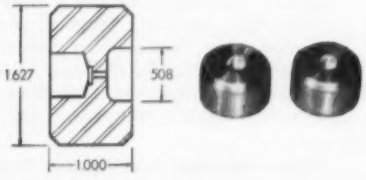
Finish turning operation on a hi-speed steel heading die, using a Monarch 13" Series 61 Air-Gage Tracer Lathe, .015" stock is removed within a limit of ±.0005". Turning time is 15 minutes compared to 2 hours previously required on a conventional engine lathe.

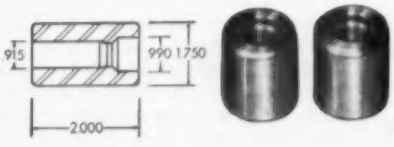
WITHOUT MONARCH–TIME'S A-WASTING!

Air-Gage Tracer Lathes Cut Contouring Time from 2 Hours to 15 Minutes — ± .0005"!

Group of typical heading dies which are finish bored on the 10" Model EE Air-Gage Tracer machines. Drawings show complexity of work. Under the same conditions as above, the same time savings are realized.







Can you ignore savings like these reported by Standard Pressed Steel Company?

They use a battery of Monarch Air-Gage Tracer lathes in their production toolroom for finishing operations on small forging dies. Most of the work is contour boring to exceptionally close limits plus quite a variety of contour turning.

The machines go sixteen hours per day, six days per week. Monarchs were chosen because of Standard Pressed Steel's previous satisfaction with this make of lathe. The Monarch flame hardened, precision ground bed ways are considered a must in this plant. These tracer controlled lathes are much faster and more accurate than the conventional engine lathes previously used and more uniform in performance.

Now, check over the job reports in the picture captions. Two hours cut to fifteen minutes! You're right — you can't ignore savings like these! Write now for our Booklet # 2608... **The Monarch Machine Tool Company, Sidney, Ohio.**

Monarch
TURNING MACHINES

FOR A BETTER TURN FASTER . . . TURN TO MONARCH

Built into your equipment

BIJUR

AUTOMATIC LUBRICATION ASSURES SATISFACTION

you benefit 5 ways

- Increase Production Capacity
- Save on Repair Bills
- Eliminate Costly Hand Oiling
- Reduce Downtime
- Lengthen Machine Life

WITH Bijur Automatic Lubrication as an integral part of your machines, you benefit from continuous peak production. Plant after plant reports increased out-put and greatly reduced maintenance costs with Bijur-equipped machines. Costly downtime for lubricating by hand is eliminated. Every bearing is metered the proper quantity of oil at predetermined intervals. Work spoilage and bearing troubles caused by over-lubrication are avoided. Fire hazards are reduced. Personnel accidents are prevented.

More than a million Bijur-protected machines are currently in use. Hundreds of leading manufacturers standardize on Bijur as "built-in" components of their machines. Bijur emphasizes custom engineering, and will gladly cooperate with your machine builder in designing a lubricating system to meet the specific requirements of the machines you order.

Bijur designed into your machines now automatically assures satisfaction. It makes sense . . . and dollars, too! Why not write today for literature and engineering information?

BIJUR LUBRICATING CORPORATION
Rochelle Park, New Jersey

Pioneers in Automatic Lubrication

NEW SHOP EQUIPMENT

Remote alarm system offers both visible and audible warning for equipment failure or overload. System works over a two-wire pair or single wire and ground return, or over plant communication circuits. It produces a blast audible for more than 2500 ft. Any condition that will operate a switch or relay will trigger the alarm.

Sparton Control Systems Div, Sparks-Withington Co, Jackson, Mich.

Limit switches of watertight design are intended for use on heavy-duty machine tools. Devices are offered in seven models, with 19 contact arrangements, 150 different lever styles, and optional mountings to fit most installations. On one test, according to maker, switch was submerged in water for more than 6,000,000 actuations without interruption.

R B Denison Mfg Co, 102 St Clair Ave NW, Cleveland 13, Ohio

Welding regulators, Airco Series 8000, are units for regulating pressure in inverse-type oxygen and acetylene operations. Two-gage type measures 4½ x 4½ in., weighs 2 lb; single-gage unit measures 3½ x 5½ in., weighs 2 lb 1 oz. Body is machined brass forging and spring case is a zinc die casting.

Airco Co International, Div of Air Reduction Co, Inc, 150 E 42nd St, New York 17, NY

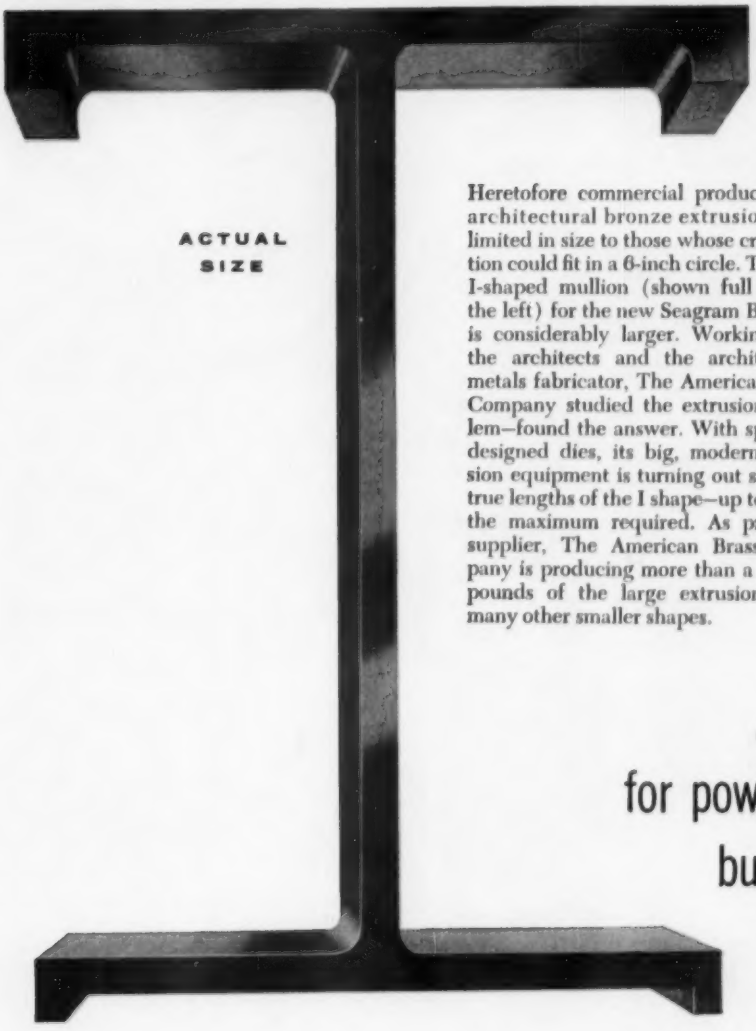
Time delay valves in 2-, 3-, and 4-way models provide delayed actuation with immediate actuation and delayed reversal. Working on volume principle, devices have manual pre-set adjustment which provides operating time of from 0 to 5 min delay. Pilot-operated units may be controlled remotely from a central station, are available in standard pipe sizes of ¼, ⅜, 1/3, and ¾ in.

Airmatic Valve, Inc, 7313 Associate Ave, Cleveland 9, Ohio

Nylon bearings in straight or flanged versions are available in 39 sizes ranging from ¼ to 1 in. ID. Said to be suitable for all shaft applications where reciprocating, oscillating, or rotating motion is involved, bearings are recommended for use with steel shafts and may also be used with brass or bronze shafts. They are reported to support loads in excess of 206 psi at rubbing velocities of 525 fpm and more. They may be used with no lubrication.

Climax Metal Products Co, 863 E 140th St, Cleveland 10, Ohio

From the largest architectural bronze shape for this building...



ACTUAL SIZE

Heretofore commercial production of architectural bronze extrusions was limited in size to those whose cross section could fit in a 6-inch circle. The new I-shaped mullion (shown full size at the left) for the new Seagram Building is considerably larger. Working with the architects and the architectural metals fabricator, The American Brass Company studied the extrusion problem—found the answer. With specially designed dies, its big, modern extrusion equipment is turning out straight, true lengths of the I shape—up to 26'4", the maximum required. As principal supplier, The American Brass Company is producing more than a million pounds of the large extrusions, and many other smaller shapes.

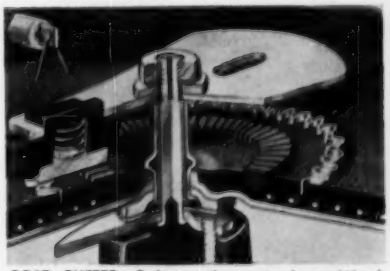
WORLD'S FIRST. The 38-story Seagram Building, now rising on Park Avenue in New York, is the first to use architectural bronze for the metal in its "curtain" walls. The large extrusion at the left forms the vertical mullions extending the full height of the skyscraper.

...to small extrusions for power rheostat contact buttons

Though not the smallest, the extruded shape, shown full size above, is typical of the hundreds of smaller industrial shapes produced by Anaconda. This extrusion has helped the Ward Leonard Electric Company, Mt. Vernon, N. Y., cut the cost of assembling its Vitrohm power rheostats.

ANACONDA has the experience and the modern equipment to make copper and copper alloy extrusions in a tremendously wide range of sizes and shapes – as indicated by these two examples. Imagination applied to the design and use of extruded shapes can cut direct labor costs – reduce machining operations – cut scrap – give improved product quality. For more information or help with your specific problems see your Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA®
Extruded Shapes



COST CUTTER. Before using extrusions, Ward Leonard hand-assembled individual brass contact buttons—spacing them on a steel wire to hold in position while vitreous enamel was fired. The steel wire was then ground off. Now an extruded brass shape is accurately slotted, leaving a continuous line of buttons attached to a triangular projection. After firing, the projection is easily milled off. Ward Leonard gets absolute uniformity, with less effort and fewer rejects—and healthy savings.

W&B "2190"...THE SPECIFIC FOR DEEP HOLE DRILLING

W&B CUTTING OIL 2190 PRODUCES AMAZING RESULTS FOR 20th CENTURY MACHINE COMPANY OF HAZEL PARK, MICHIGAN, SPECIALISTS IN DEEP HOLE DRILLING

Gustav Dabringhaus, President, says,

"We have found your oil a vital factor in performing these difficult deep hole drilling jobs." The three jobs illustrated (right) show the difficult and exacting nature of the work and the serious lubricating problem involved.

W & B Cutting Oil 2190 provides high film strength which supports the bearing surfaces of the tool and minimizes welding on the cutting edge; it offers superior penetration and wetting action; it has light viscosity for constant oil flow, better chip removal and fast heat dissipation.

May we send you additional information on W & B Cutting Oil 2190? Mail the coupon today!

Export Department:
Lamerica, Inc., 428 Lafayette Street
New York 3, New York

A
an aircraft cylinder 43 Rockwell C annealed, through which have been drilled 20 ⅛" holes evenly spaced and 26" deep. The steel bar on the left of the cylinder is M-1 high speed steel through which a ⅛" hole 12" deep has been drilled.

B
an aircraft cylinder, 43 Rockwell C, in which have been drilled 20 ⅛" holes evenly spaced and 26" deep.

THE WHITE & BAGLEY CO.
100 Foster Street, Worcester, Mass.
☐ Please send information on "2190" cutting oil—
☐ Please send, without obligation, a W & B representative to our plant for consultation . . .
NAME
COMPANY
STREET
CITY STATE

W+B INDUSTRIAL LUBRICANTS

THE WHITE & BAGLEY CO.
Worcester, Mass. Detroit, Mich.
Originators of Grinding Lubricants

NEW SHOP EQUIPMENT

MOBILE LUBRICANT DISPENSER with capacity of 80 gal consists of a tank mounted on 12-in. rubber-tire or 30-in. steel wheels. It is available with either hand or electrically operated 15-gpm pump. Called the CeCor, unit handles coolant, hydraulic and cutting oils or solvents. Several types of valving, pumps, and tank construction are available—*Coolant Equipment Corp, Verona, Wis*

Soldering and brazing torch, Model A, is an all-brass unit with wooden handle designed for a variety of operations. Ready to connect to an acetylene line, portable tool has nine tips for producing range of flames from fine to broad. Unit may also be fitted with a soldering-iron tip. Torch is available with or without valve assembly.

Huber Industries, Inc, 4962 Hillside Ave, Cincinnati 33, Ohio

Cutting-oil aerator features through-hole construction equal to nominal feed-line pipe size, with no filters or screens to impede flow or detain chips. Device introduces air directly into coolant from shop air lines. Built-in regulator with fingertip adjustment controls air feed. Unit is available in pipe sizes of ⅜, ½, ¾, and 1 in.

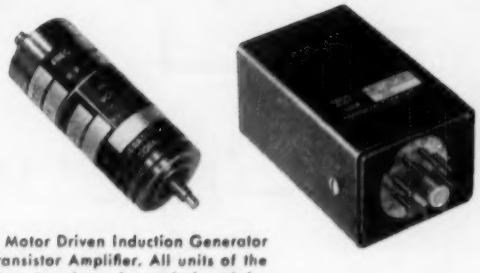
American Aerator Co, Inc, 36-B E 13th St, Paterson, N J

Nickel-base alloy, M-252, is said to be suitable for extended operation under load at temperatures of 1240 F. Vacuum-melted alloy has been applied in the construction of forged buckets in gas turbines, where high rupture strength, good fatigue strength, and high resistance to thermal shock are needed.

Metallurgical Products Dept, General Electric Co, Detroit 32, Mich

NEW MINIATURE SERVO

40% Lighter, 10% Smaller



Size 8 Motor Driven Induction Generator and Transistor Amplifier. All units of the Size 8 system have been designed for maximum performance in minimum space.

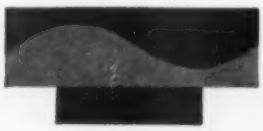
Here, no bigger than your thumb, is the smallest *practical* servo control motor currently produced. Combined with Transicoil's new Size 8 motor driven induction generator, and powered by a new completely-transistorized servo amplifier, this motor offers you the unusually high torque-to-inertia ratio of 28,000 radians/sec^2.

Compared with a Size 9 control motor—until now, the smallest practical unit available—Transicoil's new Size 8 measures only 0.75 inches in diameter, 10% smaller, and weighs only 1.4 oz., 40% lighter. Yet it operates on standard voltages from 26 to 52 volts, and 52 volts with center tap, at 400 cps, permitting push-pull transistor application.

Hence, just as Transicoil's introduction of plate to plate wiring eliminated the transformer, once necessary in servo systems, the Size 8 units and transistor amplifiers mark another milestone in miniaturization.

This is just one more example of how Transicoil can solve your control problems whether they involve miniaturization or control complexity, and go on to manufacture systems and components of the utmost precision and accuracy. You pay only for results—on a fixed fee basis for equipment delivered and performing properly.

Technical data on the new Size 8 combination and the transistorized amplifier is yours for the asking. But you'll end up with a better system if you write outlining your servo control problem.



TRANSICOIL CORPORATION

Worcester, Montgomery County · Pennsylvania

BETTER SERVICE on STAMPINGS is as simple as

Our ability to use the best of *three* stamping techniques, each our own exclusive development, assures lowest possible cost on any quantity —one to a million or more.

1 A FEW PIECES —*at Experimental or Pilot Stage*

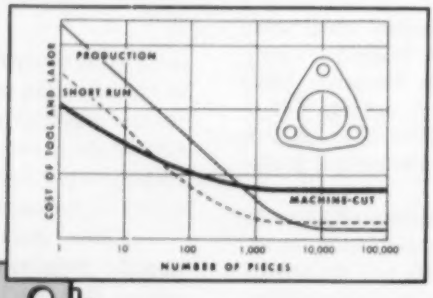
NO DIES! Our machine cut method, applying custom-built slitters, cutters, saws, files and stock punches—PLUS special techniques and skills—produce these small quantities at very low cost.

2 SHORT RUNS

TEMPORARY LOW-COST TOOLING! To produce something more than a few, but less than high production quantities, our simple contour dies—PLUS special purpose presses—keep costs low.

3 PRODUCTION RUNS

MODEST DIE CHARGES on larger quantities! Here is where our regular production toolings apply to advantage ...to deliver high quantity Stampings, and at lowest possible unit cost.



You can rely on it... WE LOOK AT ALL THREE—then determine the best method for fast, efficient, low-cost service. Let us quote on your next Stampings job.

LAMINATED SHIM COMPANY, INC.

Free 12-page booklet shows how to save on stampings... write for it.

STAMPINGS DIVISION
"One Piece or a Million"
3110 Union Street
Glenbrook, Conn.

NEW SHOP EQUIPMENT

Dye penetrant inspection is possible with Spotcheck, which indicates cracks, seams, porosity, and other defects open to the surface in practically any solid material. Portable kit is offered containing all three materials—penetrant, developer, and cleaner—in pushbutton spray cans. Each of the materials can be purchased separately.

Magnaflux Corp, 7301 W Ainslie Ave, Chicago 31, Ill

Pantograph engravers, Models UE-3 and 3D-5, have been improved by providing higher cutter-spindle speeds and a 2½ times more powerful motor. 1/6-hp, 3400-rpm motor gives spindle speeds of 18,000 rpm. Engravers now in use can be modernized by replacing motor and motor pulley.

H P Preis Engraving Machine Co, 271 Industrial Branch, U S Highway 22, Hillside, NJ

Crown Hydra-Trol remote control with positive stroke in both directions offers immediate synchronization of hydraulic control system without dependence on outside power or spring return. Improved model is self-contained for positive positioning of remote shafts, levers, and similar equipment.

Trimount Instrument Co, 3119 W Lake St, Chicago 12, Ill

All-aluminum barrel cart called Ezy-Rol is equipped with two-wheel safety brakes to give operator control of loads as heavy as 1000 lb on ramps or inclines. Wheels are equipped with ball bearings and are offered in solid-rubber or pneumatic versions. Spring-actuated chime hook speeds barrel-handling operations.

Valley Craft Products, Inc, Div of O'Neil-Irwin Mfg Co, Lake City, Minn

Drilling-machine drives for Edlund Model 2F machine are designed for long production runs either at one or several preselected speeds. Two types are available: single-speed drive with single-step sheave provides drilling and tapping operations directly from the motor through twin A-section V-belts to the spindle; five-speed drive (five-step sheave) is transmitted through B-section V-belt on a five-step sheave. Both drives can be furnished in any selection of speeds and may be changed to other pre-selected speeds, or be converted to the infinitely variable drive of the Model 2F.

Edlund Machinery Co, Div of Harso Corp, Cortland, NY

HY-PRO—the tap specialists—also specializes in SERVICE!

1. 24-hour delivery—Hy-Pro offers you 24-hour service on all standard taps. And Hy-Pro has a complete, up-to-date stock of standard taps.

2. National coverage—No matter where your company may be located, you'll find a Hy-Pro supplier located in your vicinity to give you faster service.

3. IBM equipment—The most modern IBM tabulating machines guarantee you prompt handling of your order—and insure the most accurate billing records.

4. Route specialists—Hy-Pro specialists who know the quickest, safest routes to you and to your distributors are in charge of the routing of your tap orders.

DON'T settle for just any tap when you can have the best, and have it on time.

Hy-Pro specializes in tap production, and in service, too, giving you the quickest, most complete service possible. One of the reasons that Hy-Pro is among the leaders of the tap industry is this insistence on speed as well as efficiency.

If you have the need for the right taps *at the right time*, pick up a phone or write a note to Hy-Pro. You'll never find better taps or better service.

Remember, Hy-Pro protects the quality of the taps you buy with its exclusive 3-Way Quality Control.

1. Heat-Treating—insures tap toughness with the tap industry's newest equipment.
2. Electronic Analyzer—checks hardness uniformity.
3. Micro-Hardness Tester—analyzes metallurgical structure.

This quality insurance is available at Hy-Pro at no extra cost to you.

REG. U.S. PAT. OFF.

HY-PRO

"The Tap Specialists"

New Bedford, Massachusetts, U. S. A.

ADDITIONAL WAREHOUSES:

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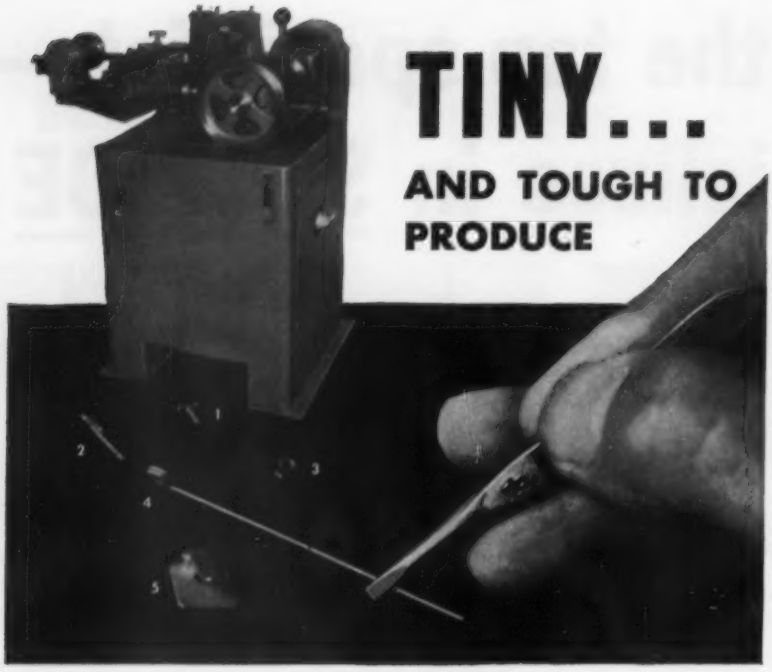
DETROIT 21, MICH
UNIVERSITY 4-1077

11232 LAWLER ST (WORTH)
CHICAGO, ILL
GARDEN 4-0217

109 EDISON PL
NEWARK 5 N J
MARKET 2-4516



TINY...

AND TOUGH TO PRODUCE

INTRICATE FORMING IS AUTOMATIC ON A NILSON 4-SLIDE

Small wire and ribbon metal forms shown here in actual size are typical examples of modern precision production on a Nilson #00 4-Slide. Compact in size, this 4-Slide produces up to 375 pieces per minute in material not exceeding .040 dia. and 3" in blank length. Easy access to tooling, accurate feeding to within .003, and rugged construction assures years of precision forming.

1 Mercury Switch Part . . . .014" x .019" platinum wire, formed with tolerances within .001" on over-all length. Production rate, 175 per minute.

2 Electrical Contact . . . .0076" x .0030" wide phosphor bronze formed at a production rate of 200 per minute.

3 Swivel Part . . . .025" brass wire. Heading operating includes eye formed with tolerances within .008", shank within .003 tolerance. Production rate, 300 per minute.

4 Leadwire . . . .026" soft tinned copper wire formed at a rate of 140 per minute with two 7/64" diameter windings.

5 Contact Part . . . .010" x 3/16" wide phosphor bronze formed at 175 per minute.

Nilson makes a complete line of versatile 4-Slides . . . accommodating wire diameters up to ½", feed lengths up to 32", and ribbon metal up to 3" width . . . with press capacities ranging to 75 tons.

Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogs . . . the first step to increased production.

A.H. NILSON MACHINE COMPANY

1519 RAILROAD AVENUE, BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

ROUND TABLE *Discussion*

COFFEE BREAK, WORK BROKE

Is the coffee break a symbol of increasing laxity in shop working conditions? Is productivity actually affected one way or the other by an official "time out for relaxing"?

ED'S OPPOSITION to the creeping time-killing socialization of the coffee break leads me to think that he comes from the old school where men really took their jobs seriously or, presto—some more "want ads."

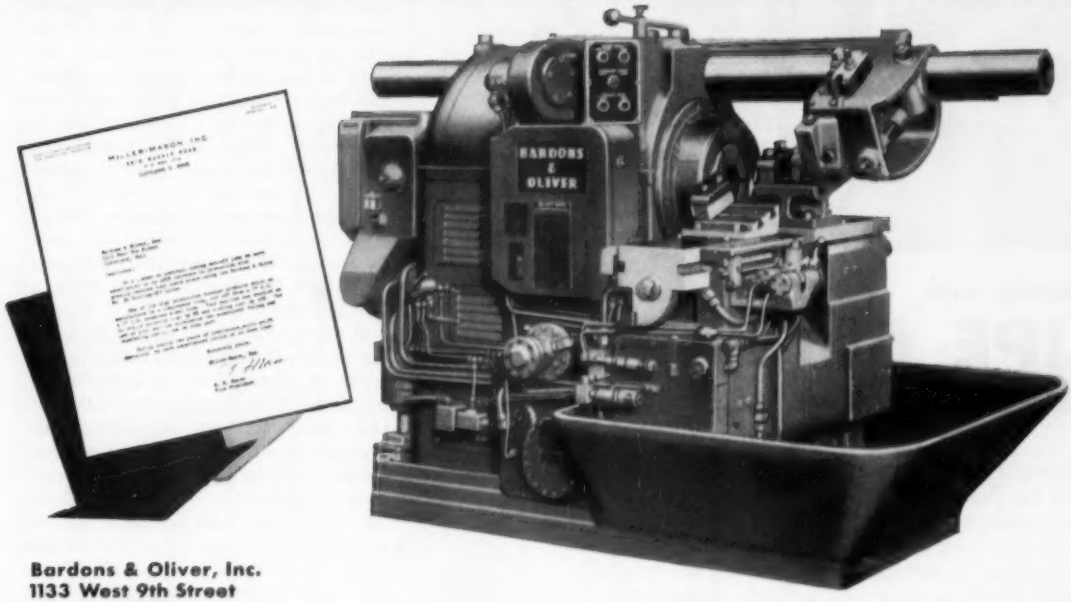
Jobs in the old days consumed most of the worker's day—in winter time he went to work in the dark and went home in the dark. How times have changed! He didn't arrive at the plant in a two-toned this-or-that, dressed like a Fifth Avenue honkytonk; he either hoofed it several miles or else hung desperately on some street car. The poor guy had to beat the whistle and strip for action fast. Now his highness has to drown himself with a cup or two of activated bean juice, go through the post-TV review with his pals before starting to lift a finger. Yes, Eddie, my poor deluded friend, they've got you backed to the wall where you have to stand and like it, or else. Remember, pal, you're an executive in name only and you'll have to console yourself with the fact that you do

"I was just teasing it a little with some conflicting facts—."

400% Production Increase

REPORTED with BARDONS & OLIVER

CUTTING-OFF LATHE... at Miller-Mason, Inc., Cleveland, Ohio



Bardons & Oliver, Inc.
1133 West 9th Street
Cleveland, Ohio

Gentlemen:

On a number of contract tubing cut-off jobs we have experienced up to 400% increase in production with greatly reduced tool costs since using the Bardons & Oliver No. 36 Cutting-Off Lathe.

One of the high production tubular products which we manufacture is a compressor ring, cut-off from a 7" O.D. x 5" I.D. seamless steel tube. Your machine has enabled us to reduce tooling cost by 50% and material cost by 8%. The use of your machine eliminates two subsequent facing and chamfering operations on this part.

During nearly two years of continuous, multi-shift operation, we have experienced little or no down time.

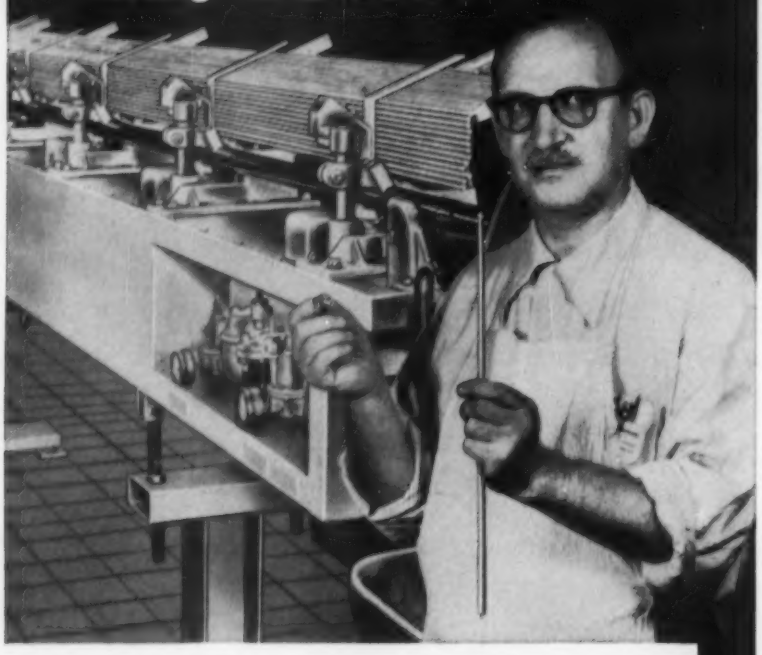
Sincerely yours,
Miller-Mason, Inc.
R. E. Mason
R. E. Mason
Vice President

Manufacturers of a complete line of Turret Lathes and Cutting-Off Lathes.

BARDONS & OLIVER, INC.

1134 WEST 9TH STREET • CLEVELAND 13, OHIO

"Stop Cutting Air and you Start Cutting COSTS...



Just equip with

LIPE Automatic

MAGAZINE LOADING BAR FEED"

Says Foreman Billy Smathers*

"We put in two Lipe AML Bar Feeds as a test," explains Foreman Smathers. "At the same cutting speeds as our other screw machines, the AML-fed machines turned out the two pieces I hold in my hands, 78% faster for the small ⅞" piece, and 108% faster for the 16" piece. That opened our eyes . . . but quick! Yet the reasons were perfectly obvious. The Lipe AML's fed stock without pausing. No cutting air. No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. The AML's geared our production to the steady pace of the clock . . . so many units of output per so many units of time. Overall, the gain was astonishing!"

WRITE OR WIRE for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe AML Bar Feeds in your production layout.

* Photographer's models and pseudonyms used to protect company identity and confidential information.

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

Machine Tools • Heavy-Duty Automotive Clutches • Portable Power Hack Saws

have the privilege of salaaming the chevalier d'industrie periodically to make an apologetic suggestion in regard to the work at hand.

Having unloaded that from my over-burdened chest I'll get on with this time-killing coffee business which from Ed's viewpoint threatens to undermine the foundation of business profits. Were we to mix a little refreshment with sound executive control I think we can arrive at a solution of Ed's nightmare.

There is an expression "give a man an inch and he'll take a yard" that seems to fit this coffee-break business to a T. Were every worker honest in his conception of the rights of his employer we would have no difficulty in running this break business satisfactorily to all concerned. However, we are not as yet on the other side of the pearly gates, and to expect this condition to prevail in this cut-throat, I'll-get-my-take society is hoping for too much. Boys will be boys and lots of the boys are stinkers as far as clear thinking is concerned. With such to be contended with there must be some other means of prying the coffee-break obstacle from its destructive moorings. Come forth, Houdini, and give us a clue. We've got the coffee and we've got the men but we need a break in wisdom.

If there is an obvious violation going on in relation to the coffee-break hour, or minutes, to be exact, then the refreshing session will not correct itself without pressure. This pressure must come from the outside —the power relegated to the one or ones in authority. You will notice that in a prize fight a buzzer sounds to warn the seconds to get out of the ring. Could we have a similar condition to warn the worker that he's got time for a gulp or two before the final bell is rung, notifying him that it's time to go back to work? I've noticed that no one hesitates to dash for his cup of coffee on time, so why shouldn't the worker show the same zeal when it's time to get back on the job? Maybe I'm expecting too much.

There is another practice pretty well allied with the time-wasting habit of stretching out the coffee break and that comes under the heading of "take five," or "take ten." In a shop I worked in a while back it was the practice, when the boss was out of range, for one of the boys suffering ennui to blast out with a "take five" and immediately all the fellows would have an elbow session for a few minutes. These sessions occurred at a costly pace until the foreman got wise to what was

Tear this chart out and preserve it

YOUR GUIDE TO COLUMBIA HIGH SPEED TOOL STEEL GRADES

TYPE AND GRADES	DESCRIPTION	HARDENING RANGE	QUENCH	TEMPERING RANGE	USEFUL HARDNESS
T1 — CLARITE	Standard type, high red hardness, good strength, wide range of use with high over-all efficiency	2000° F. to 2350° F.	Oil or Salt Bath	1000° F. to 1250° F.	65/60 Rc
T2 — VANITE	Increased carbon and vanadium; best for form tools and finishing cuts	2300° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1050° F.	66/63 Rc
T4 — ACMITE	18-4-1 high speed steel with 5.00% cobalt added; for heavy cuts, all around high speed cutting with long life at high speeds.	2325° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1025° F.	66/64 Rc
T5 — COBITE	18-4-2 with 8.00% cobalt high speed steel, extreme red hardness, for hogging cuts on scaly and hard abrasive materials	2325° F. to 2375° F.	Oil or Salt Bath	1000° F. to 1100° F.	66/64 Rc
T8 — MAXITE	High carbon, high vanadium with 5.00% cobalt. High production steel for cutting hard castings and tough heat treated alloy steels	2325° F. to 2375° F.	Oil or Salt Bath	1025° F. to 1075° F.	66/63 Rc
M2 — MOLITE SMOOTHCUT	Molybdenum-tungsten multipurpose high speed steel with smoothcutting additives for greatest economy	2100° F. to 2275° F.	Oil or Salt Bath	1000° F. to 1250° F.	66/58 Rc
M3 — MOLITE 3	Molybdenum-tungsten high speed steel with higher carbon and vanadium for fine cuts including broaching and reaming	2175° F. to 2250° F.	Oil or Salt Bath	1000° F. to 1100° F.	66/63 Rc

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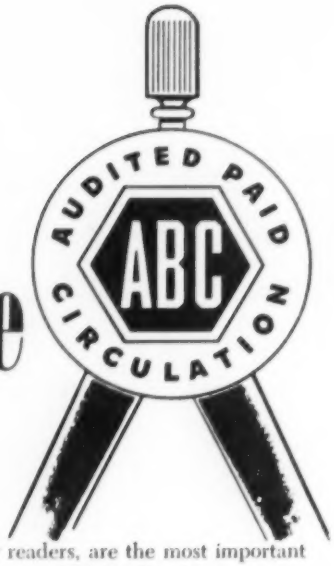

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MEASURE OF SERVICE...MARK OF INTEGRITY

going on and did he raise particular hell! He got the boys together and like a stern father he gave them a pretty stiff Sunday school lesson on the meaning of honesty.

So, like the "take five" evil, the coffee-break trouble boils itself down to a lesson in honesty backed up by executive manipulation. Ed, if you can't overcome the encroachment of time-killing practices by measures entrusted to your care, then shut the doors of your shop and use it for a warehouse.

Jack Everett
San Francisco, Calif

I DO NOT agree with Ed's idea to buy whips to get the work out. There are, however, certain types of employees we must get tough with. Generally, the democratic method of management is the accepted practice. Autocratic management will cause discord and resentment. Free-rein management will find the more aggressive taking advantage.

The coffee break is fine if it is firmly controlled. It is up to the foreman to see that the employees do not take more than specified time, and that they do not leave the department. It is humane treatment to allow the employees time out to drink their coffee.

It is Ed's fault if he does not get any work out till 8:30 in the morning. The employee is paid to work 8 hours a day and the foreman's duty is to uphold the rules of the company. It does not do any harm to remind some employees the hours they are paid to work. It is the department head who rants, raves and loses his temper who hurts the morale of the department. Humane

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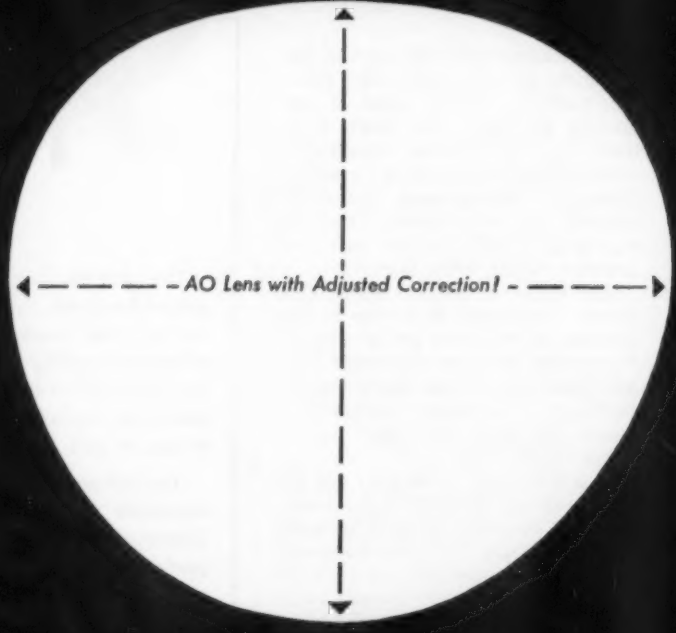

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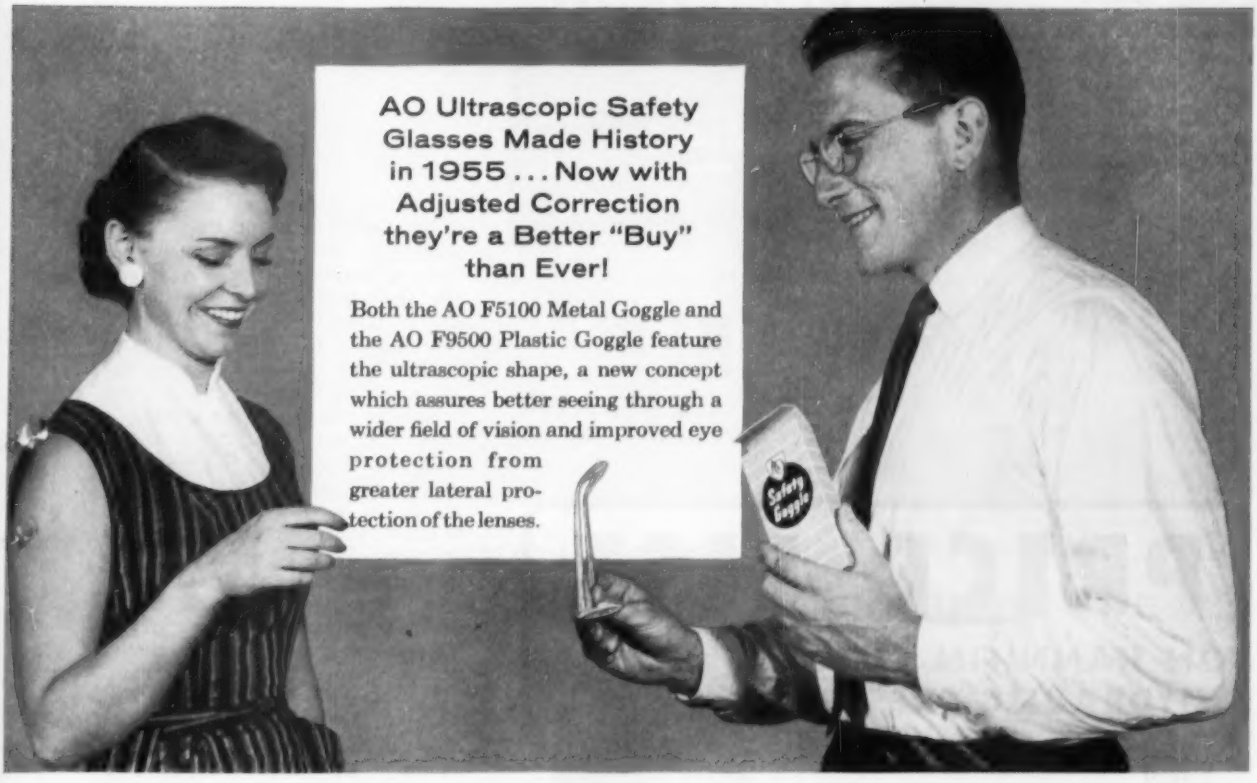
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NOSE PADS — Acetate, won't corrode, easily replaceable. Very comfortable — they spread goggle weight evenly.

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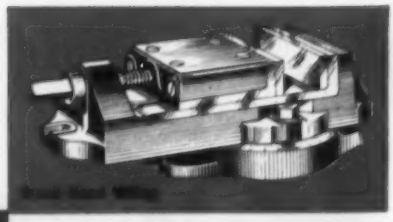

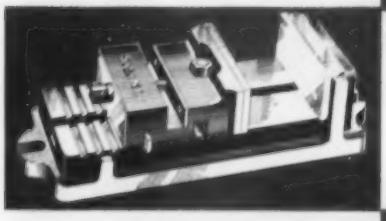

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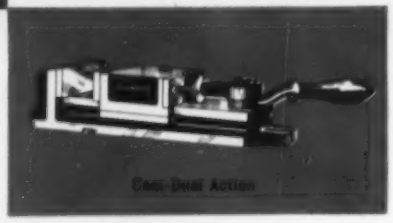

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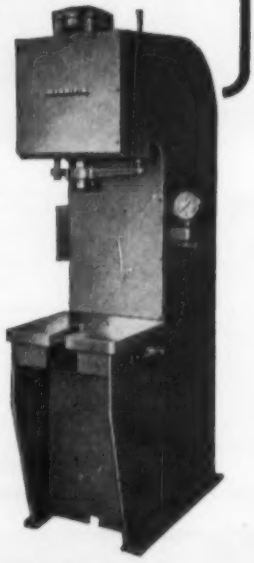

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treatment does not mean an easy-going, liberal attitude toward work habits.

Someone, somewhere once said: "In the south is an old man with a rowboat who ferries passengers across a mile-wide river for ten cents. Asked, "How many times do you do this?" he replied, "As many times as I can because the more I go, the more I get. And if I don't go, I don't get."

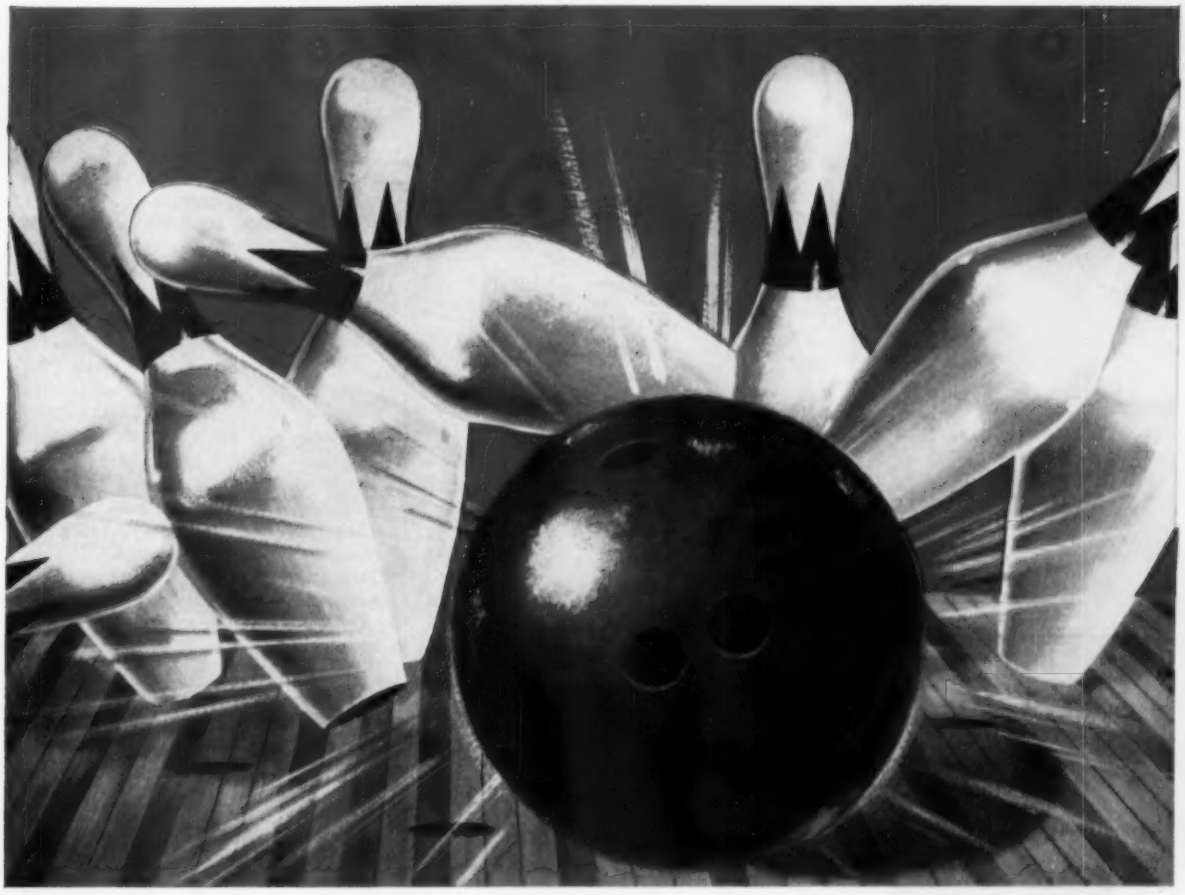
That's all you need to know, all there is to know about business, economics, prosperity and self-respect.

A E Salmons
Norristown, Penna

FROM the number of notices relating to breaks and spells-off that are appearing in the press of many industrial countries, it would appear that the trend is being overworked, if the trenders aren't. That is a heartening sign and would seem to indicate that management is coming awake again. This deplorable habit of getting something for nothing is largely, if not wholly, due to the misdeeds of management and employers generally. If they *will* ignore the moral law they are simpletons to expect their employees to observe it. If they *will* set a bad example they need not be surprised if the men copy them. Imitation is the sincerest flattery.

Management and employers should not feel annoyed with the men wanting a coffee break; they should feel flattered. Let them put their own house in order, let them set a good example and they will have a stronger case. Using the term "moral" in its widest sense, it is immoral for management or employer to take time off for drinking coffee or anything else. The men are neither knaves nor fools, neither are they blind. They see the tray taken regularly to the directors' room, to the manager's room, sometimes to the shop foreman's office. They come to regard the practice as quite in order, the done thing, and how many bosses can fairly blame them? The thing is all wrong, it is no better than poaching and should be dealt with accordingly, starting at the top.

The habit is a pernicious one and doesn't carry a decent excuse. Office workers are high on the list of offenders; that takes in a large number of directors and managers. They have



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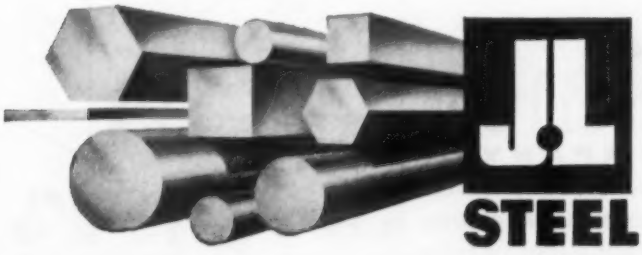

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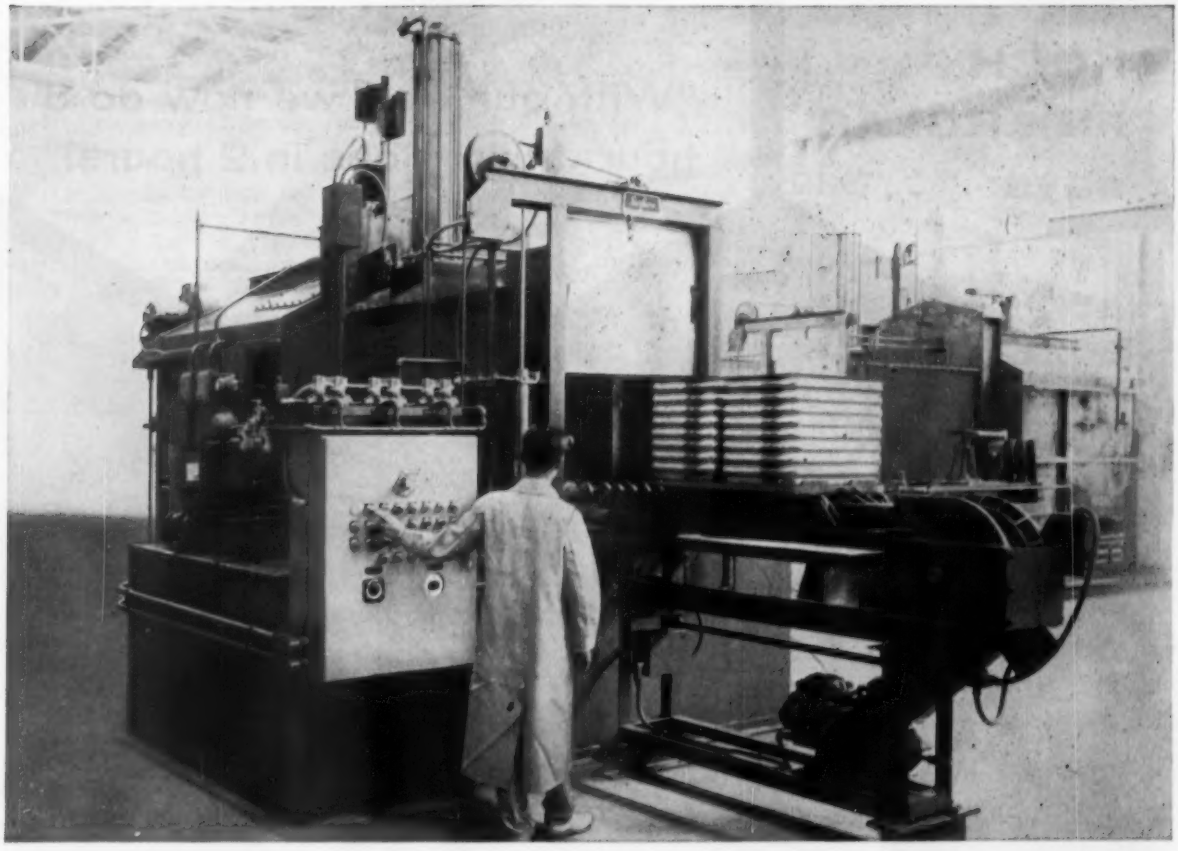
the feeblest of excuses because they work short hours, yet one sees those 9 o'clock starters trooping out to the works canteen at 11, even if their midday meal is at 12:30. Mostly, the habit took hold because the office chief detailed one of the girls to bring a tea tray into his room at 11 each morning. In time, the others paid him the compliment of imitating his bad example. Eventually, it spread to the shops. I have every sympathy with Ed. I wholeheartedly share his views.

The boss who never visits the canteen during working hours has little or no trouble with the men on that score. They are just as likely to follow a good example as a bad one, and in many cases, more so.

Al says "Things are getting more liberal all over, and about all we can do is to keep up with them." That is wholly in character with the employer's attitude of taking the easy way out instead of treading the hard road and taking the thing by the throat. Retreat, retreat, retreat and the devil take the customer. There is no need for employers to outbid each other in liberality in order to attract labor to the works. Being faint-hearted is not being liberal, and in this case, competing for labor in such a squalid fashion is the easy way out of the mean-spirited.

The men, through their unions, are nationally organized. A whole industry may be laid idle if a few of the employees are thought to be unjustly treated. *They* don't compete in so-called liberality; they present the pistol. The employers could pay the unions a compliment here by taking a leaf out of their book. If no company competed in liberality the demand for it would fall in time. We might then see a return to sanity



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in the form of a fair day's work for a fair day's pay. That might call for self-discipline on the part of the bosses. No more tea trays to the ivory towers, no more golfing afternoons, no more afternoon race-meetings.

No, I don't think more relaxed working conditions help output. I do think things are getting much too sloppy. I fear the current trend will go on and on, getting more and more unreal till a halt must be called. The cure will then be infinitely more difficult to effect.

J C Ball
Stranraer, Scotland

Shops and industrial plants have always been faced with the problem of keeping the employees in motion. Human beings just do not have an inherent natural desire to exert themselves. People do not work for the sake of working, but to provide the means of subsistence.

For most jobs there is a certain unwritten minimum amount of output expected. Workers who fall below this level are discharged. In general the tendency is for the output of the employee to gradually decline. This is because the temptation to ease off is always present and to the individual employee it does not seem serious to take a few minutes extra at lunch time or during a coffee break. It is necessary for the success of the plant for management to constantly work and fight to combat this tendency.

At the present time there is less pressure applied to the employee to maintain a high output, and control is becoming more relaxed all the time. This situation is not the result of technological improvements with the subsequent improvement in output. It is the result of the present employment situation. There are plenty of jobs available and management makes these concessions in an effort to get and keep their employees. The laws of supply and demand are always in operation and when the demand for labor is high it is wise and necessary to increase the attractiveness of the position. However it is never under any circumstances, desirable to permit sloppiness, laxity, or weakness to exist in the control of shop activities. If management feels that they should allow a rest period, a coffee break, or other concessions, they should define it clearly and positively so

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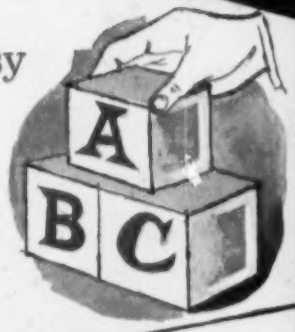

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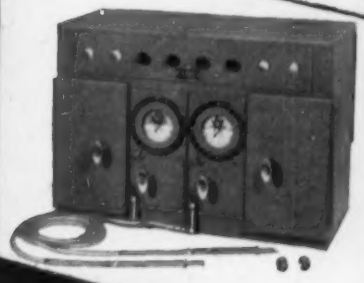
assembled
as required



* **Automation Gaging . . .** uses a "feed-back" control system to re-set the machine as required to maintain work tolerances AUTOMATICALLY at all times. The results are: increased production, greater accuracy, fewer rejects . . . and greater profits!

AND NOW . . . an Automation Gaging installation . . . custom tailored to your exact needs . . . can be assembled quickly and easily from standard, in-stock Pratt & Whitney Package Units. The big expense and long delays of specially constructed control equipment are eliminated.

LEARN HOW practical the advantages of Automation Gaging can be applied to your production lines. Phone the nearby P&W Branch Office and ask a Pratt & Whitney Gage Specialist to call at your plant . . . or write direct to West Hartford outlining your requirements.

PRATT & WHITNEY COMPANY
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MACHINE TOOLS • GAGES • CUTTING TOOLS

NILES 72" Heavy-Duty Engine Lathe: Swing over bed and carriage wings is 73½" . . . over carriage bridge, 56". Main drive accommodates 150 hp., adjustable-speed, 4:1 DC motor (with variable voltage drive optional). Speed ranges—1.35 to 101 rpm or 2.2 to 151 rpm (optional).

Metalworking News from HAMILTON!

New NILES 72" Engine Lathe for faster set-ups,

Here's welcome metalworking news from Hamilton! An all-new 72" heavy duty engine lathe to boost your turning speeds and accuracy . . . for top machining quality at lowest cost. It's the Niles A72 Lathe with these exclusive bonus features:

Speed and load indicators on faceplate drive . . . for constant operator check on machine performance. Permits capacity loading with no danger of applying excessive overloads.

Adjustable, springloaded tailstock quill with load indicator . . . for accurate quill spring preloading to suit work piece. Cuts setup time and prevents damage to centers.

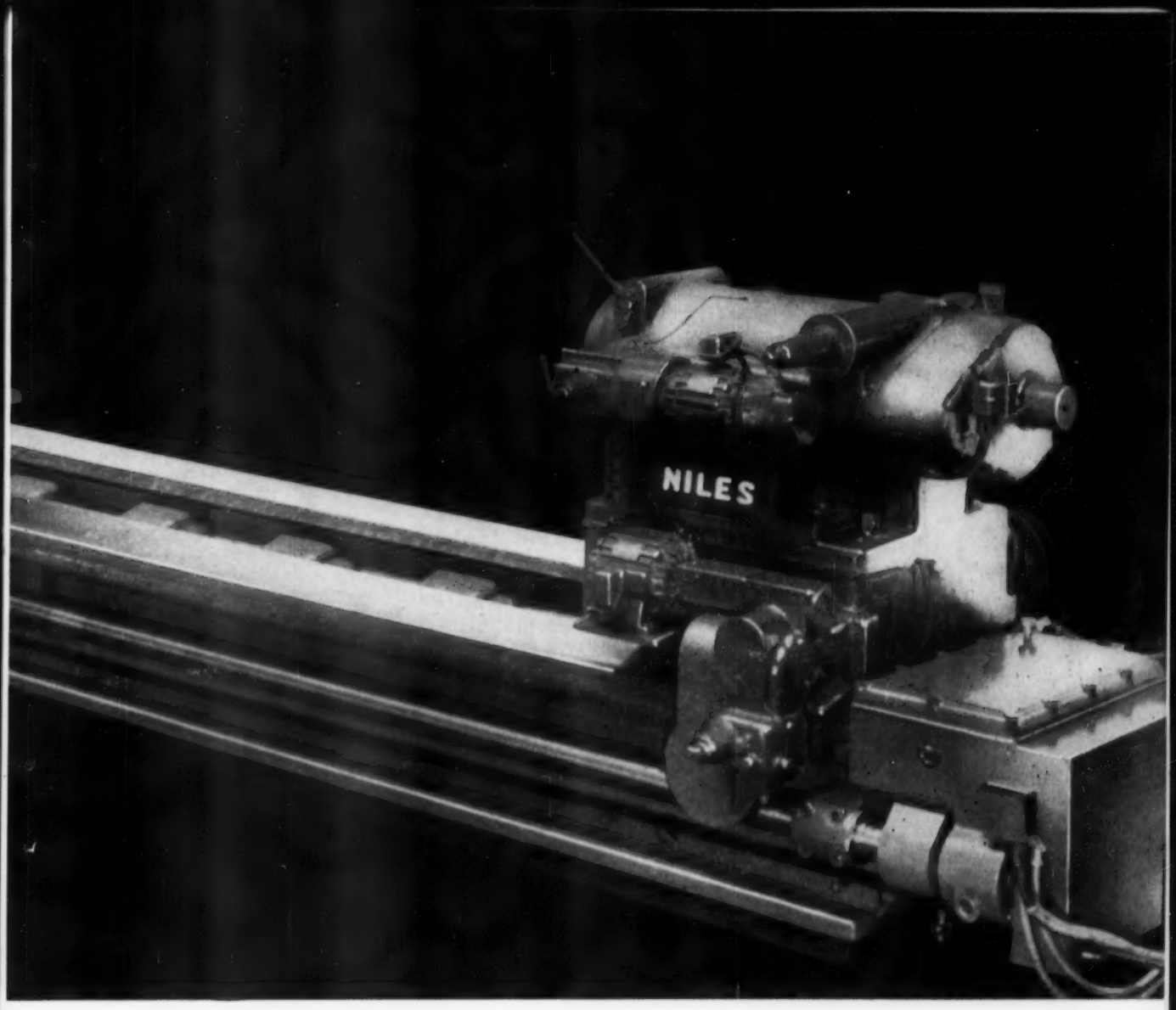
Fully enclosed leadscrew and thread selector dial . . . outmodes old-style tumbler gear selector. Eliminates opening where dust and dirt can enter to contaminate gear lubricant and foul machine operation. *Safer too!*

Hydraulic booster on faceplate speed changer . . . eliminates the heavy manual labor needed to change speeds on other large lathes.

Lubrication oil-pressure safeguard . . . prevents operating machine until positive lubrication is applied.

Optional electronic or mechanical feeds . . . with one lever selection and full pushbutton control at carriage station for either feed. Safety interlocks prevent simultaneous engagement of both. Number of feeds available: 64!

Put this new Niles A72 Lathe on *your* shop floor! You'll speed set-ups, cut machining time and slash operating costs on your heavy duty turning jobs. Easy, accurate controls make child's play of close tolerances. Get complete details on the all-new Niles A72 Lathe today. Send for new bulletin containing full specifications. Address: Dept. 9802, Hamilton Division, BLH Corporation, Hamilton, Ohio.



more accurate turning—at lowest operating cost

Look to HAMILTON for the engineering know-how, experience and facilities that mean outstanding performance *for you* from the full line of NILES Machine Tools:

NILES Heavy Engine Lathes—50″, 60″, 72″, 84″, 96″ and larger

NILES Vertical Boring and Turning Mills—12′, 14′, 16′, 30′ and 43′

NILES Railroad Tools—Hydraulic Centering Machine, End Drive Axle Lathe, Hydraulic Car Wheel Lathe, Hydraulic Diesel and Car Wheel Borers, Hydraulic Axle Burnishing Lathe

HAMILTON Mechanical Presses—single, double and triple action presses for metal forming and stamping; also open back inclinable presses, rail presses, welding presses and die fitting machines

BALDWIN BLH LIMA-HAMILTON

HAMILTON DIVISION
BALDWIN-LIMA-HAMILTON

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Abrasive Cutting | *the best way to cut many materials the only way to cut some*

Allison Cut-Off Wheels

Wide variety of shapes and materials cut with abrasive wheels

• Speed and quality of cut make abrasive cutting ideal for a wide range of operations. For example: one inch diameter cold rolled steel can be cut with a wheel cost of under ½ cent per cut and in 3 seconds.

ALLISON Cut-Off Wheels can provide smooth, high-quality cutting for almost any type of material however hard. These include steels of practically all analyses including corrosion-resisting types, brass, bronze, Monel Metal and other non-ferrous: aluminum alloy, magnesium and many others.

Whatever the problem there is an Allison Wheel to meet it . . .

Profitable abrasive cutting means using the right abrasive wheel . . . and the proper abrasive cut-off machine . . . for the specific job. If the required result is a smooth, fine finish, without hardening or metallurgical changes, a WET cut is called for. Rubber bonded ALLISON Wheels give long wheel life and high quality cuts for such an operation. If the cut is a big one (over 2" solid) an OSCILLATING Cut-Off machine . . . with the proper ALLISON Wheel . . . will do the job fast and economically. Where quality requirements are less exacting, dry cutting with ALLISON resinoid bonded wheels is often the best method.

Allison
ABRASIVE CUTTING WHEELS

Consult a specialist for best results

• ALLISON specializes in the manufacture of abrasive cut-off wheels. Be sure that you are getting the most from your cutting methods. Abrasive wheel cutting is faster than sawing—in some cases it is 10 to 20 times as fast. The savings in cost can be tremendous. Why not let an ALLISON abrasive cutting specialist check your hardest cutting job?

ACCO
TRADE MARK

Send for Booklet "ABRASIVE CUTTING" Today

ALLISON DIVISION
AMERICAN CHAIN & CABLE
254A Island Brook Avenue, Bridgeport 8, Conn.

there can be no misinterpretation. A weakly defined policy or lax enforcement leads to a "just one minute more" on the part of the employees. Within a few weeks this attitude can stretch a 15-minute break into a 30-minute one. Decisive action is required and hard feelings result when the company tries to shrink it back to 15 minutes.

In the matter of break-time or other phases of company policy and operation it is essential to maintain strict and complete control and to abide by the principle that "a rule worth making is a rule worth enforcing."

Sing Yen
Brooklyn, NY

THE COFFEE break, like every privileged granted, can be a benefit or it can become a nuisance. In my opinion a great deal depends on the way it is handled.

In the first place, if ten minutes is set as the allotted time for the break, then no one should be allowed to exceed that time any more than they should be allowed to walk out of the shop before quitting time and expect to be paid for it. This, of course, requires that supervision should be alert to see that shop rules in regard to the break are not infringed. If supervision makes no effort to do this then a certain few will take advantage and in time the more level-headed employees will catch the infection and a sloppy situation will result.

From my own experience I can remember working in a locomotive

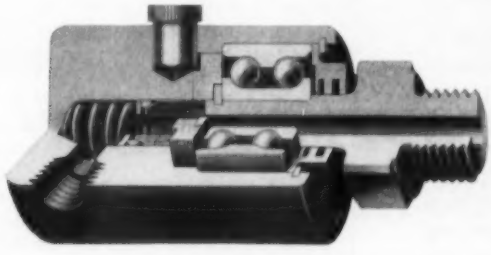
use these FAWICK products

for better transmission of air and liquids into rotating shafts

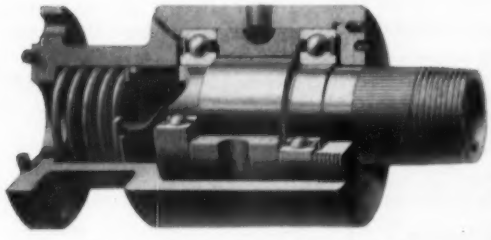
FAWICK ROTORSEALS

. . . for introducing air or liquids into a rotating shaft

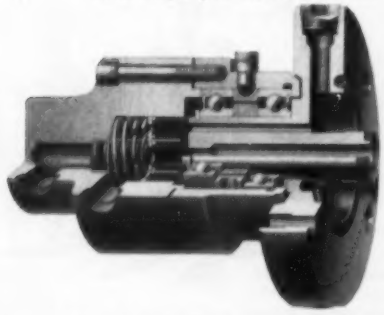
Fawick Rotorseals are positive seals providing passage for air, gases, steam, water or oil under pressure (to 1000 psi) or vacuum from a stationary source into a rotating shaft (reversible to 2500 rpm). Threaded shaft or flange mounting provides simple installation. Through-hole sizes range from ⅛" to 1½". Ball bearings are pre-packed for life at the factory. Single or multiple passages are available.



Fawick "B" Rotoresal for all types of single-passage applications



Fawick "RH" Rotorseal for large volume single-passage applications



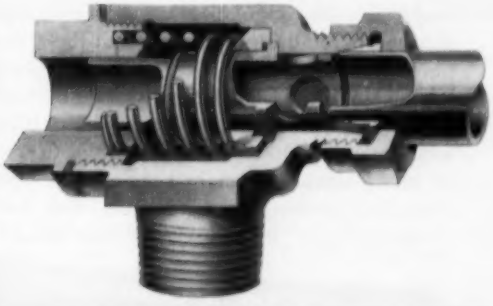
Fawick "BD" Rotorseal for all types of dual-passage applications

FAWICK QUICK RELEASE VALVES

. . . for discharging air under pressure quickly

Fawick Quick Release Valves provide quick evacuation of pressurized air from pneumatic systems. Action is instant and positive regardless of location relative to controls. These devices feature:

. . self-cleaning action with no lubrication required
. . male pipe thread outlet connection and tube fitting inlet connection
. . adapter for pipe-to-tube inlet connection (optional)



If you use air or liquids under pressure in your plant, investigate these proved-in-use Fawick Rotorseals and Quick Release Valves. For more information, call or write your nearest Fawick Representative or the Home Office today.

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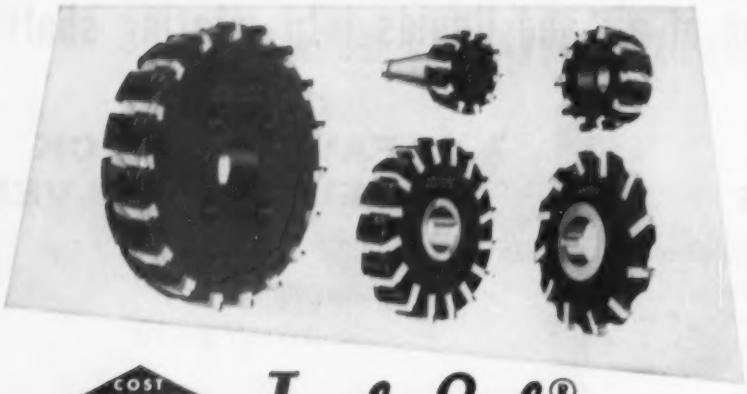

COST CUTTING TOOLS

Jack-Lock® MILLING CUTTERS

featuring the nationally shop-proved *Jack-Lock*® Blade Locking Wedge

• McCrosky Milling Cutters combine the rigidity of solid tools with the longer life, greater economy, and lower cost of inserted blade design. They match the speed, feeds and power potential of modern milling machines. The powerful Jack-Lock wedges lock the blades rigidly and accurately in the body. No hammering or pounding on a drift. Blades can be locked while positioned against an indicator. Consequently a minimum of blade stock is lost in regrinding — reducing sharpening time and prolonging blade life. Get full details about the complete line! *Write for a bulletin today!*

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. . . Send the coupon today!

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Gentlemen:
Please send Bulletins describing the tools checked below.

- ☐ *Jack-Lock*® MILLING CUTTERS
- ☐ *Block-Type* BORING BARS
- ☐ *Super*® *Adjustable* REAMERS
- ☐ *Turret* TOOL POSTS
- ☐ *Wizard*® QUICK-CHANGE CHUCKS
- ☐ *Specially Engineered* MULTIPLE PRODUCTION TOOLS

Name_____ Title_____

Company_____

Address_____

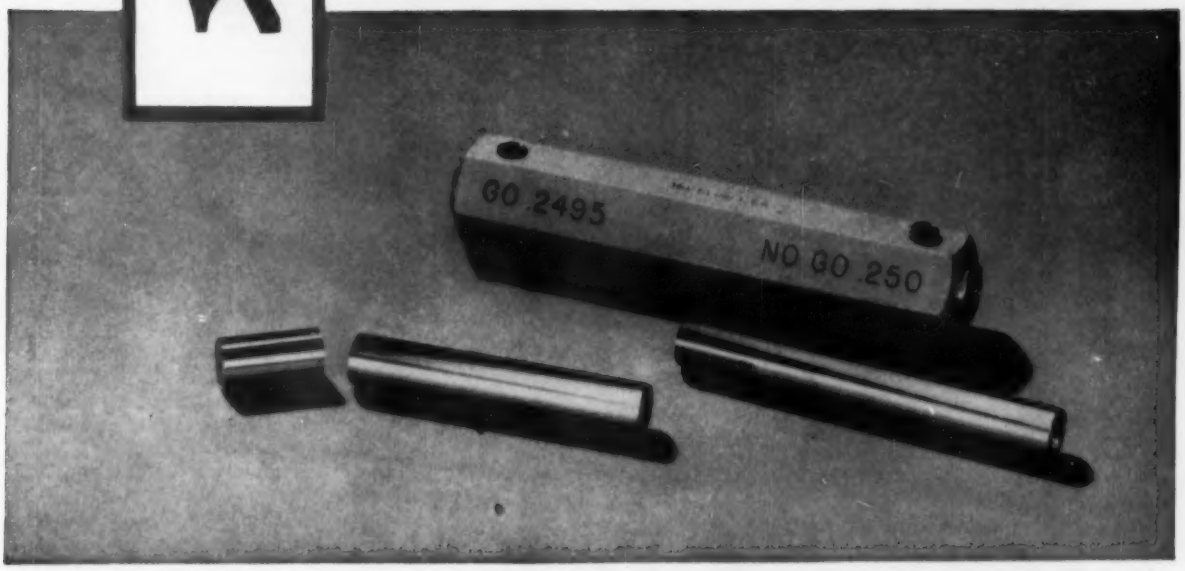
shop during World War I. In those days smoking was not allowed in the shops. This company decided to allow a ten-minute smoking period during the morning and afternoon. However, within a few months it changed its policy; smoking was allowed at any time during the working day. What happened was that the employees would light up about a minute or two before the smoking bell would ring and a gang would get together to discuss the latest topics. When the bell to resume work rang there might be a heated argument going on, or the conversation would be so interesting that the bell would be ignored. When smoking was allowed at any time the idea of ganging up went out of favor and the company saved considerable money because the individual employee could light up his pipe or cigarette while his machine was running or while laying out a job.

With the so-called ten-minute period, the company actually lost twenty minutes of productive time as very little was accomplished five minutes before and after the break. I believe this is the nub of the whole situation, because no one in management actually objects to the idea of a coffee break, as such. What is objected to is the tendency of some employees to prolong the stipulated time.

I am of the opinion that no employee should be allowed to infringe upon the allotted time for the coffee break anymore than any other shop rule. If the foreman chooses to overlook an infringement of the rules then he has only himself to blame, if what is a privilege is allowed to be abused.

Robert S Alexander
Glastonbury, Conn

VK WIRE TYPE PLUG GAGES



VASTLY LONGER-LIVED *and* MONEY SAVERS...
because they're "Cut-Off-Able" as well as "Reversible"

As a Van Keuren agent put it, "Theyre not only reversible, they're cut-off-able." And that means when you buy Van Keuren Wire Type Plug Gages, the sizes below 3/8" may be cut off when ends become worn and as many as from five to ten gages made available from the 1 3/8" and 2" long units. It is not only economical and practical to use Van Keuren Gages but it is a very simple operation to cut off the ends by following instructions furnished on request. The illustration above shows clearly the cut-off and reversible features.

VK Wire Type Gages are available in ZZ to XXX accuracies in sizes from .001" to 1.000". They are furnished in alloy tool steel, high speed steel, chromium plate or tungsten carbide. Whatever the gaging job, the extra length provided in VK units will save you money. It will also pay you to take advantage of VK deliveries. In many cases we can ship your requirements from stock.

VK Wire Type Pluge Gages are fully described in Catalog & Handbook No. 36, *available on request.*

Send for a copy of the new, 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

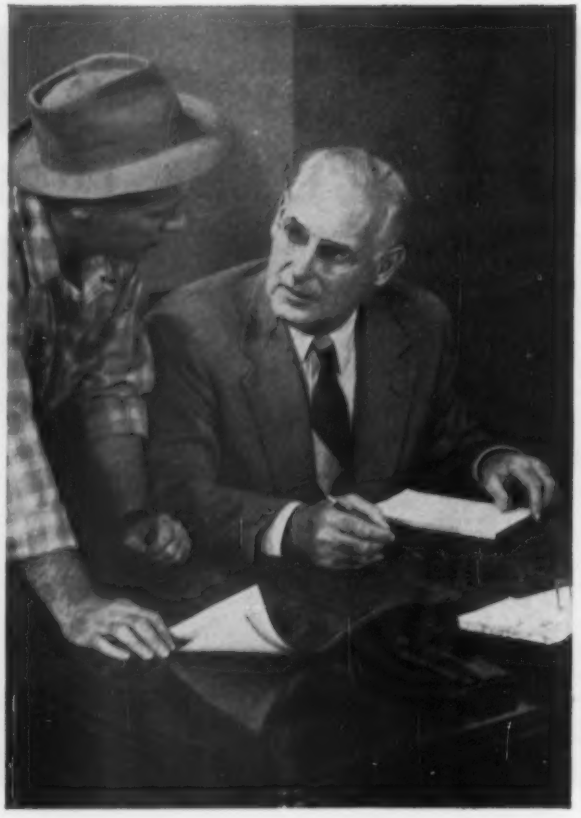
VK

37th YEAR

THE Van Keuren CO.

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.



rush it to CDT

Get those tough special design jobs off to Columbus Die-Tool for quick action. An outstanding engineering staff backed by 50 years of Company experience can make tough jobs look easy.

Whether it's special tools, jigs, fixtures or even special machinery, you'll find that CDT can build them better, faster and more economically. That's why so many of the nation's leading manufacturers regularly avail themselves of the specialized services of Columbus Die-Tool.

Perhaps we can solve your tooling problem and help you make your product . . . better, for less.

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ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

INSTALLMENT BLUES

Is a raise in pay, or a promotion, the answer for the man who has gone over his head in debt? Won't he be just as liable to incur further debts with a little more money in his pocket?

It looks as if Ed has one foot in the fire and the other in a hole in the ice. Aside from that, he has a hard place to turn around in.

My belief is that when a workman gets into a tight place usually the first idea that flits into his mind is "I'll ask the boss for a raise." This may be due to financial toubles, or it may be that his wife has been nagging him.

One man, who had many creditors, placed a sign on his front door which read "On vacation. Next, please," Another, who was four months behind in his rent, found a "To Rent" sign on his front porch. So he approached the agent and said "I see 208 is for rent; all right, I'll rent it," then paid a month's rent, went home, and took down the sign.

The temptation to buy on the weekly or monthly installment plan is reaching practically everybody, and is hailed by many as a Godsend. As one man said, "It's only a buck or two a week, so what the hell, Bill; it's easy to pay off a little bit at a time."

Many families get along on the earnings of the family head and, while they may not look as spruce as many, it is the right way to live.

Some men profit by changing to another town, and come out on top. Others have a tendency to slight their creditors and try not to pay up at all, which is downright dishonesty. In the long run, the man who pays as he goes is the best off, though about 50% buy things on the installment plan.

On the other hand, there are firms who consider their employees and their interests. In at least one plant where they do this they have one of their personnel department act as a counselor to help employees to straighten out their personal affairs and advise them how best to keep within their incomes.

As for Ed, he may approach the brass and let them work out some system whereby his man may get help. There was a time when the brass did not dip into such matters without first getting down behind the trunk to talk it over, but today it is quite different, for many employees are stockholders, and this helps everybody.

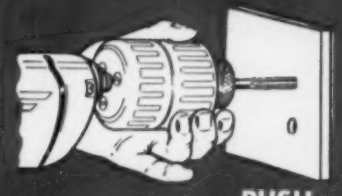
F H Stebbins
Worcester, NY

NEW!

NEVER BEFORE A TOOL LIKE THIS!

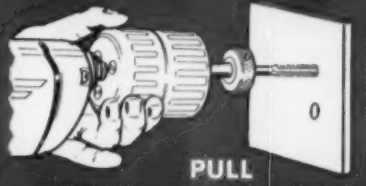
TAPPING to highest industry standards with ordinary portable drills

HOW IT WORKS . . .



PUSH

and the tap runs in smoothly . . .



PULL

and it comes out easily . . . That's all you do **PUSH-PULL!**

Cut tap breakage with the easy to use, safe to use

SUPREME **Push·Pull Tapper**

Complete PUSH-PULL TAPPER Kit includes 5 collets to handle all taps up to 5/16" diameter. List price is **$29.95** complete. (Taps not included.)

Big shops and small shops alike will find this new tool the answer to hundreds of tapping problems. It is small, light, safe to use, and inexpensive, yet it will solve most of your tapping problems.

The *Supreme PUSH-PULL TAPPER* is an instant-reversing speed reduction unit made expressly for tapping. By means of the adapters it can be attached easily to either the spindle or chuck of any portable drill. Detachment after use is equally simple. The speed reduction of 7:1 gives more than adequate power to tap in all materials, and the instant-reversing means that the direction of the tap can be reversed without stopping the drill motor. Thus the tap can be moved into and out of the hole at will.

Tap breakage is held to an absolute minimum when the *PUSH-PULL TAPPER* is used. This is because the operator has a better "feel" for his work. When in use the *TAPPER* housing is held in the finger-tips, and any unusual strain is felt immediately. Releasing the fingers stops the tap instantly.

One owner, using the *PUSH-PULL TAPPER* on an important government job, tapped 1500 holes in one casting without one deficient hole, and without a single broken tap. Another decreased the amount of tap breakage enabling them to change to a tapping operation that resulted in increased assembly production.

Examine your own tapping operations, and you'll see that the *PUSH-PULL* has advantages you can utilize. It handles all taps up to 5/16" diameter, and the five necessary collets are included. Also included are wrenches for tightening collets and for removing or tightening *PUSH-PULL TAPPER* to drill spindle. Ask your Mill Supply Distributor or write direct.

By the makers of Supreme Brand Chucks

These chucks are "Up Front on leading power tools."

Look for these great chucks on the new tools you buy . . . specify them for all replacement. The exclusive Supreme hardening process assures long, accurate, trouble-free service.

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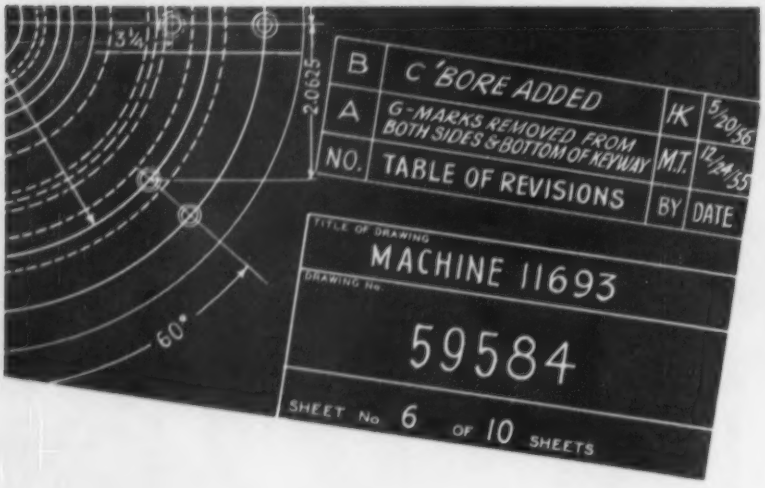
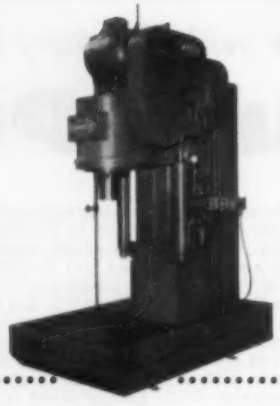


AUTOMATION

even though you don't have rigid stability of design

Here's automation that can be easily retooled for changes. For Baker Basics are *standard* machines that don't have to be "rebuilt" when you change your product or production methods. What's more, they cost much less than a machine specially designed for only one part. Accordingly, they pay for themselves even on lower production runs. Yet you still get *full* automation with loading and unloading devices and conveyors . . . which we can furnish as well as tooling. Use singly or in battery as a transfer machine . . . for drilling, boring, tapping, facing and other machining operations.



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AUTOMATION
Best in the long run
Practical in the short run

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Please give me the full story on automating with Baker Basics.

NAME AND TITLE

COMPANY

ADDRESS

CITY ZONE STATE

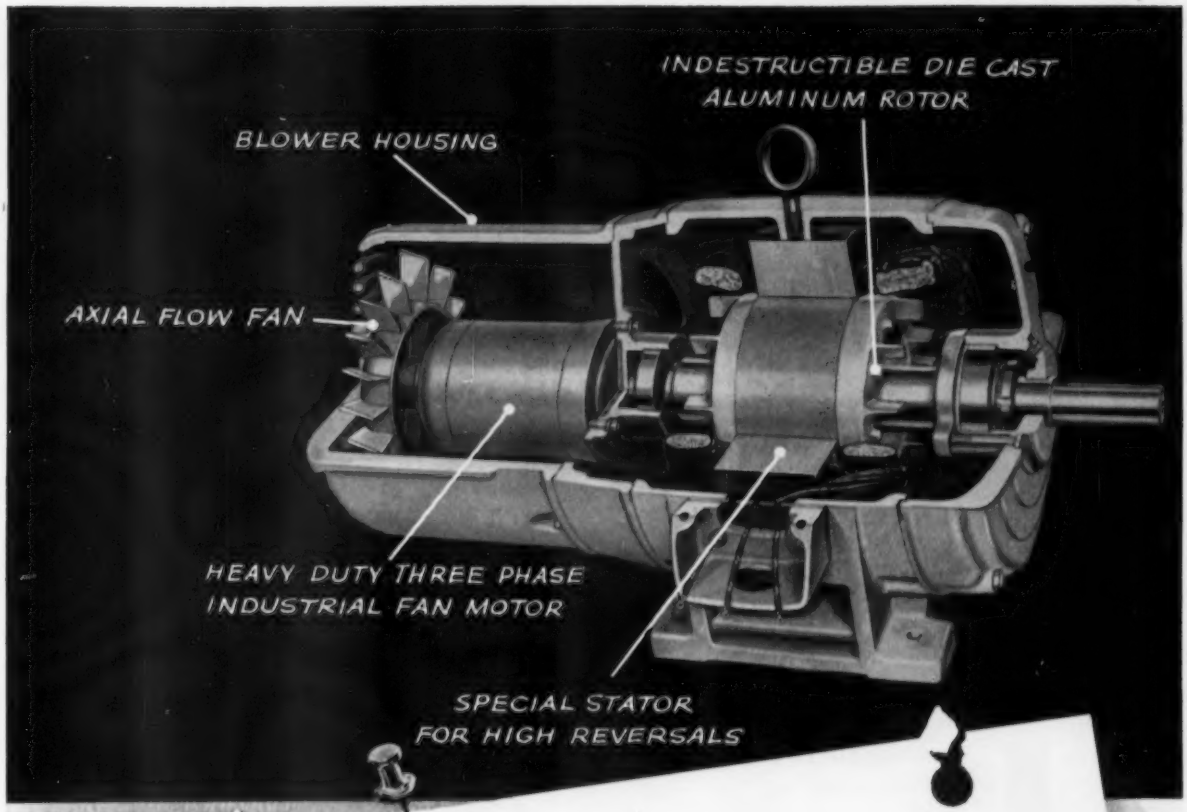
SICK LEAVE OR FREE VACATION

Should unused sick leave days be added to a worker's vacation time? What is the best means of handling the problem of the man who takes such leave unnecessarily, and then actually does become ill?

Is there any way to police sick leave without getting into trouble? It is well nigh impossible to police any racket or any dishonest employee without incurring some degree of displeasure, and that usually means trouble. Likewise, it is almost impossible to police every racket or every dishonest employee. That does not mean, however, that no attempt to discourage dishonesty should be made. If a company grants its employees five days per year with full pay, to help them out when they are unable to work because of illness, that is an act of faith on the part of the company and no honest man would abuse the privilege by breaking faith with the donor.

I think that is a fair statement, and I further believe that the great majority of people are honest and conscientious. A medical man is neutral; furthermore, he can judge with fair accuracy if a given man is unfit for work. Roughly, sickness can be divided into two categories, walking cases and bed cases. In either case, the works doctor should be notified immediately, even if absence from work may be for only one day. A man may feel off color and unfit for work, but may be able to enjoy and benefit from a quiet walk in the fresh

"Five'll getcha ten my Boss has the greatest volume!"



212 idle reversals per minute*

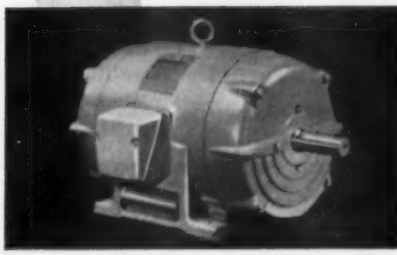
Special blower assembly continuously cools Louis Allis rapid-reversing motors, to permit high rate of reversals

Here's a motor built especially to withstand the tough demands of rapid reversal applications. It is kept cool by its own integrally mounted blower that forces cooling air through the motor and over the windings and end rings.

Other factors that lead to long dependable motor life are: Large stator slots and special slot shapes that allow maximum copper in the windings. Specially annealed and coated lamination steel that reduces losses and increases the number of reversals possible. New Phenolic impregnating varnish that protects the insulation with outstanding thermal and chemical resistance for Class A insulation. Also built with Class B and H insulation.

These reversing motors meet standard NEMA mounting dimensions except for the increased length caused by the addition of the blower. And you can get constant torque or constant horsepower ratings in single and multiple windings for two or more speeds. Sizes range from 1/2 to 15 hp. See your Louis Allis field engineer for complete information about this remarkable new motor development.

Send for bulletin 1800 describing these new motors.



A complete line of standard rerated motors in frames 182 through 326U now in stock. Special rerated motors are available on short delivery.

*3 HP, 1200 RPM with Class H Insulation

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MILWAUKEE 7, WISCONSIN

ACHIEVED!

the theoretically

Perfect Point...

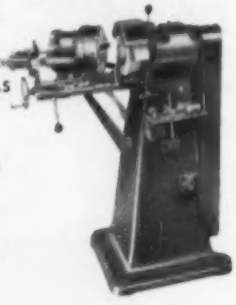
by

Oliver

DRILL POINTERS

The Model 510 Oliver Drill Pointer will provide these advantages . . .

- A THEORETICALLY PERFECT POINT WITH INCREASED CLEARANCE AT THE WEB OF THE DRILL PERMITS FASTER AND EASIER PENETRATION.
- SHARPENS 2, 3 AND 4 FLUTE DRILLS, RIGHT HAND SPIRAL. (GEARING FOR LEFT HAND DRILLS AVAILABLE AT EXTRA COST.)
- VARIABLE CLEARANCES FOR ALL DRILLING CONDITIONS.
- INCLUDED POINT ANGLES FROM 82° TO 160°.
- ¼" TO 3" DIAMETER CAPACITY.
- AVAILABLE FOR EITHER WET OR DRY GRINDING.



PROOF? Send a few drills to Oliver to be repointed at no cost . . . use them . . . then buy Oliver.

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air. Such a case could reasonably be expected to report either to his family doctor or to the works doctor. A walking case could do so without injury to his health.

In any event, reporting would be proof of willingness to be medically examined if necessary. Should the weather be unfavorable, someone could be found to put a phone call through to the works doctor; that also applies to bed cases. Arrangements such as those suggested are in operation in some British factories, even where no days with pay are granted for sickness. The idea is that when the works doctor is notified of illness he pays a social call, in order to show an interest in the worker's welfare. That call also serves as a check on the man's claim to be sick. Such a call is not, of course, a professional visit. The man's National Health Service doctor attends professionally.

Some shops on this side of the Atlantic have, in addition to the National Health Service scheme, a private works sickness and holiday club, run by a voluntary committee of management, elected each year by and from the membership. Every member pays an agreed sum to the club treasurer each week, which sum is entered on his club membership card. An agreed sum is paid each week to each member, during sickness. There are six visiting committee men who are responsible for two monthly periods of sick visitation. If leadswinging is suspected, a visit may be paid in the evening of the first day of absence. It may even be paid during the day at the meal hour break. That arrangement establishes the validity or otherwise of the sick claim, and the knowledge that a visit may be paid tends to keep the unscrupulous fit!

In common with all other organizations, the sick club has its black sheep and, naturally, they are known and taken care of by the elected visitors. The arrangements are not foolproof, but the fact that the sick-visitor may call at any time makes leadswinging somewhat rare. Immediately before summer holidays, cash on hand is divided equally among the members, the accrued interest, plus a sum voted, remains in the savings bank as a nucleus for a fresh build-up. That constitutes the holiday part of the scheme. From the foregoing, it will be seen that the workers themselves require proof of sickness before any financial payment is forthcoming.

I am in complete agreement with Al on that point, and I am no believer in blank checks. They are a

Here is an entirely new series of clutches combining, in a single compact unit, all of the PROVED advantages of MAXITORQ Floating Disc Clutch design with an exceptionally simple, powerful, and dependable electro-magnetic actuating mechanism.

As will be seen from the illustration, the new clutches use standard proved MAXITORQ Disc-Pacs, quickly and easily replaced. The electro-magnetic unit is enclosed in a stationary housing, permitting direct wiring connection. When energized, the magnetic coil acts through an armature plate and sleeve to exert pressure on the clutch discs. Pressure, however, is maintained entirely by the magnetic flux, without mechanical contact between moving and stationary parts.

This unique design permits instant, positive engagement or disengagement, with the additional possibility of precisely controlling torque for a gradual pick-up or release of load. In addition to meeting standard clutch and brake installation requirements, MAXITORQ Electric Clutches open up new possibilities in application to fully automated equipment and for remote control.

Standard sizes, single and double types, are available for either wet or dry operation to transmit up to 788 lb. ft. of torque, operating on 110V–AC rectified to 90V–DC.

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- **PROVED** performance.
- **COMPACT** design.
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- **POSITIVE** engagement.
- **STATIONARY** coil . . . no brushes.
- **NO ADJUSTMENT.**
- **WET OR DRY** operation.
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temptation to the thriftless and are always open to abuse. Weak natures never appreciate something for nothing, and when it comes their way, instead of being grateful, they employ every trick they know to squeeze the lemon. We must not, of course, lose sight of the fact that it is the relatively unscrupulous minority that have to be carefully policed, whether in the factory or in the street. The great body of work-folk can be counted on not to betray a trust. Many of them realize we are not here merely to make a living but to make a life.

Al is definitely on the right line when he asserts there ought to be some way to make sure the men use sick leave only when they are really under the weather. Whatever method is used, even if it is not watertight, there should be an official attempt to discourage dishonest conduct. This is one case in which almost any kind of attempt is better than none. If, unhappily, there is no method, that is an open invitation to sharp practice. Ed's thinking has gone woolly when he holds "you can't demand a doctor's note each time a man says he's been sick." Why not? the company is paying him his wages during sickness, five days each year. One wonders if Ed would pay a grocer's bill which simply demanded, say, $40, and did not include details of the articles delivered. The man who claims sick pay must shoulder some responsibility and must be prepared to be at some trouble to get it.

Recently, I had a claim from three men employed on marking off, to be put on piecework. It was pointed out to them that theirs was mostly short-operation work, many parts taking only from ten to fifteen minutes to execute. The men concerned were paid considerably higher than the prevailing district rate in lieu of piecework and in order to avoid the clerical work involved in making out some twenty or thirty PW cards, per man. They argued they could earn more on PW. When it was pointed out to them that every job would require to be booked in and the exact time shown against, they offered to increase their output by 50% and book "details, order No. so and so" if the company would agree to pay time-and-a-half.

Under that arrangement, there would be no check on the number of parts done. I was to be content with their promise to increase their output by 50%. I had heard similar arguments before and, needless to say, I wasn't rising. An offer to price each job was not acceptable because of the trouble they would have keeping the exact time of a lot of small operations and booking them. All that happened some weeks ago and, so far, nothing more has developed. This is somewhat extraneous to Al's poser, but the cases are similar and amount to "give us something but don't ask us to do anything." "Don't ask us to get a doctor's line in proof of sickness."

Ed holds, mistakenly, it makes no difference if a man uses up his gift five days' sick leave and, later, is off, actually sick, for five days. In the man's case, he loses five days' pay unnecessarily and in the case of the company, it loses ten days' production when it need only have lost five if the man had played the game and remained at work when not sick.

There is no cure for money-hungry men coming to work when off color. It is equally difficult to persuade the keen, conscientious man to stay off so long as he can stand up unaided. Ed is simply beating the air, here. Nothing he may say or do will make any difference. Unless compelled, the money-hungry would not take their five days off until the last five working days of the year. The conscientious would probably not relish five days of idleness if fit to work.

It is a safe bet that both categories would take no days off if the company made a rule to pay the five days as a bonus to all who made no sick claim throughout the year. Thus, those with clean slates would be richer by five days' full pay and the company would profit to the extent of five days' production from the men concerned.

C Donald
Lanarkshire, Scotland

"And furthermore, I don't like your attitude towards my suggestions."

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More and more manufacturers apply SIP *Guaranteed* Accuracy to define, establish and maintain high precision in production and measurement to improve quality-of-output and economy-of-operation.

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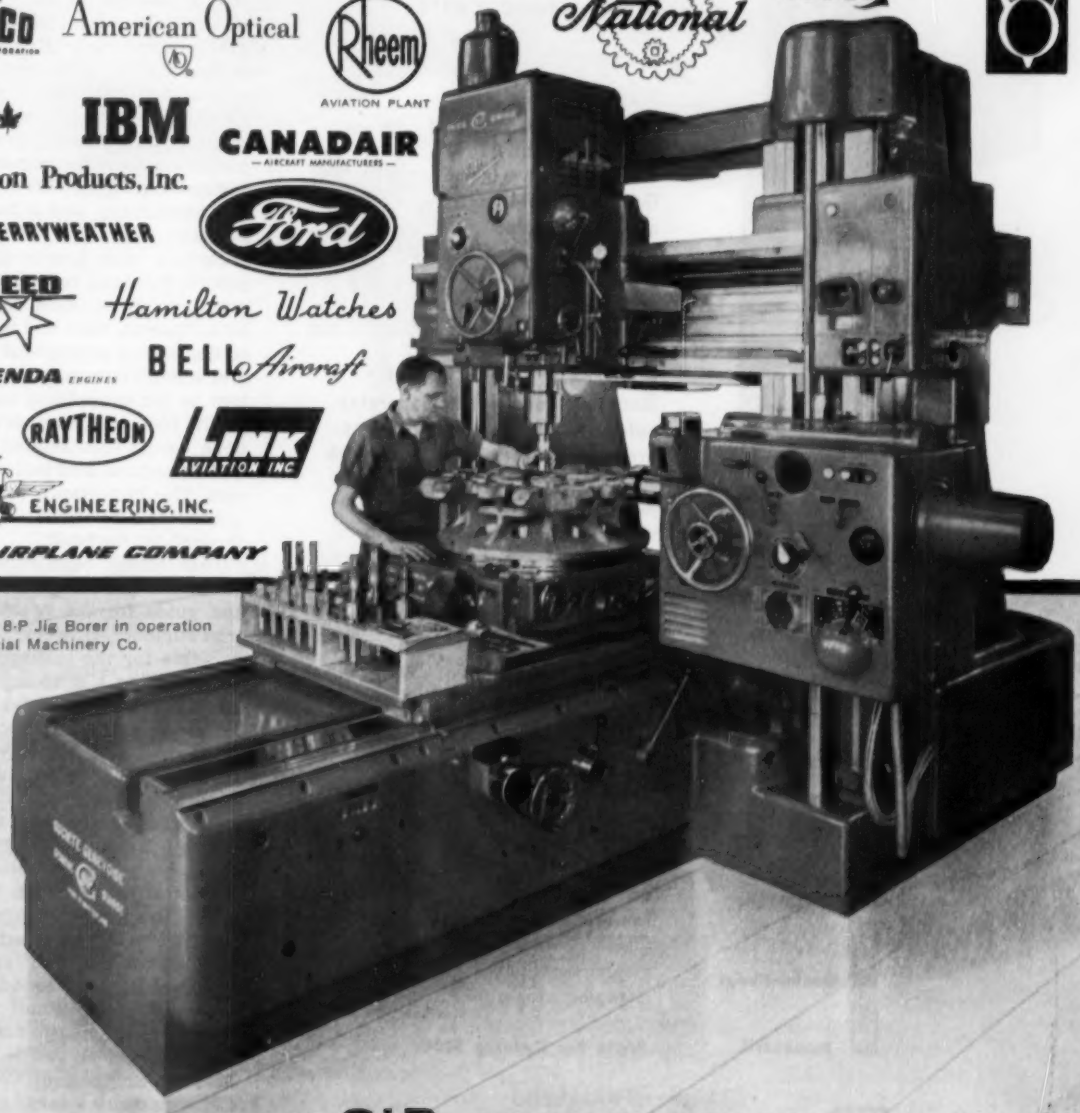

SIP HYDROPTIC 8-P Jig Borer in operation at Hartford Special Machinery Co.

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New Books...

INDUSTRIAL ENGINEERING HANDBOOK—
Edited by H B Maynard. Published by McGraw-Hill Book Co, Inc, 330 W 42 St, New York 36, NY. 1504 pages. 648 illustrations. Price $17.50.

Now, for the first time, a handbook of principles, data, methods, and procedures of Industrial Engineering is available in this broad, authoritative treatment of the whole field. Working under the editorship of one of the most distinguished leaders in the field, scores of experts have contributed a measure of their experience on such diverse topics as the industrial engineering function, work measurement, predetermined elemental time standards, wage payments, plant facilities and design, shop layout, linear programming, methods-time measurement, methods engineering, operations research, control procedures, and a host of other subjects.

Factual and how-to-do-it in approach, the book covers many varied practices, from such long-accepted techniques as time and motion study to the newest concepts of automation and scientific management. In addition to the procedures used directly by the industrial engineer, this handbook covers such related subjects as quality control and tool and gage design. The importance of human and industrial relations is stressed throughout the book.

This really outstanding book is published primarily as a reference and guide for the practicing industrial engineer. However, it is equally valuable for the manager of a business, helping him to organize, guide and direct the industrial engineering function, and the function of his business, most effectively. As a guide and "coach" to students of industrial engineering, this handbook should prove as useful as a dictionary to a student of language. It provides both the structure and the details of construction.

The book is arranged for efficiently locating any particular phase of the subject and an extensive index adds to its broad value.

The Editor-in-Chief, Harold B Maynard, is a world-renowned consulting engineer and is president of Methods Engineering Council. In addition to many awards of recognition in the field, he has served as a consultant to the Secretary of War. This book is highly recommended.

A GOOD MAN TO KNOW FOR INDUSTRIAL LUBRICATION

No service is better than the men behind it. That's why Atlantic lubrication consultants, such as the man you see in the illustration, are experienced men with years of on-the-job knowledge of heavy industrial lubrication requirements.

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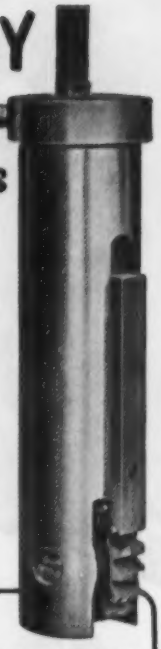
The INSIDE STORY about NATIONAL Keyseating Millers



NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations that a keyseating machine can't reach. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed Rockwell hardened steel, accurately ground to size. Tops of teeth are staggered to break chips which reduces strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

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complete, handy size

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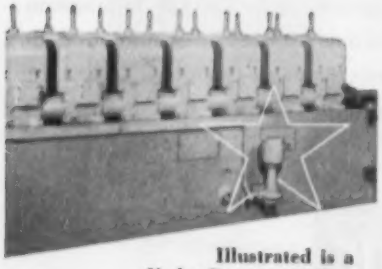
Ruthman Gusher Coolant Pumps



Illustrated is a Yoder Forming Mill—equipped with a Ruthman Gusher Coolant Pump.

You get instantaneous coolant flow, from trickle to full volume, the moment the machine starts, with a Gusher Coolant Pump. The electronically balanced shaft reduces wear from vibration to a minimum. The pre-lubricated ball bearings require no maintenance attention. From every angle, Ruthman Gusher Coolant Pumps are better.

THE RUTHMAN MACHINERY CO.
1818 Reading Road Cincinnati, Ohio

Names in the News . . .

Ralph C Reinhart has been appointed director of manufacturing for Baker Raulang Co. He was formerly director of operations research for Otis Elevator Co, the parent company

Robert P Laughna, formerly vice president and general manager of the Packard Clipper Division of Studebaker-Packard Corp, has been appointed director of planning and material control for Chrysler Corp's Automotive Group.

Morehead Patterson, president of American Machine & Foundry Co, New York, has been elected chairman of the Nuclear Standards Board of the American Standards Association.

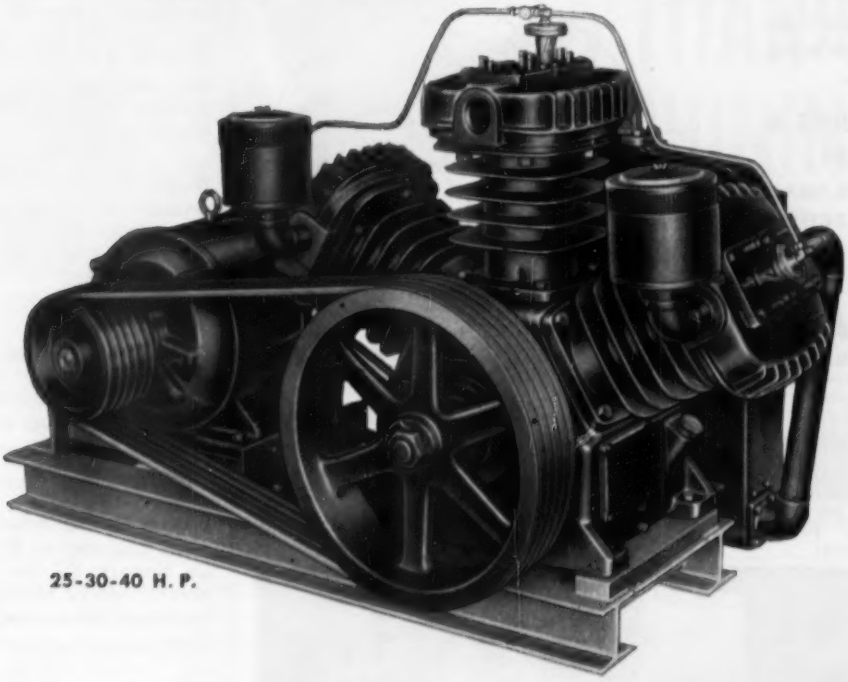
George L Barton, consulting engineer, has joined Greist Manufacturing Co, New Haven, Conn, as manager of special product sales.

R T Johnstone, engineer, has been appointed assistant sales manager for The Cross Co, Detroit.

Marvin C Bonine, formerly plant manager for Yale & Towne's Salem, Va, plant, has been appointed manufacturing manager of Federal Pacific Electric Co's Pacific Switchgear Div, San Francisco

THE NEW CURTIS MODEL C-100
TWO-STAGE, AIR-COOLED AIR COMPRESSOR

Provides Higher Operating Efficiency
Costs Less to Install



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THIS NEW Curtis Two-Stage will deliver more air per minute, per horsepower and per kilowatt hour of electrical energy consumed, thus assuring a saving in your electrical bill.

It's Air Cooled, thereby eliminating expensive water bills and assuring quick and easy installation with no complicated plumbing problems.

The new C-100 embodies all the well-known Curtis engineering features such as centro-ring oiling and Timken Main Bearings.

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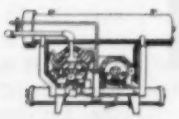

PACKAGED LIQUID CHILLERS

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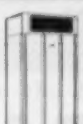

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ELIMINATES JIGS & FIXTURES!

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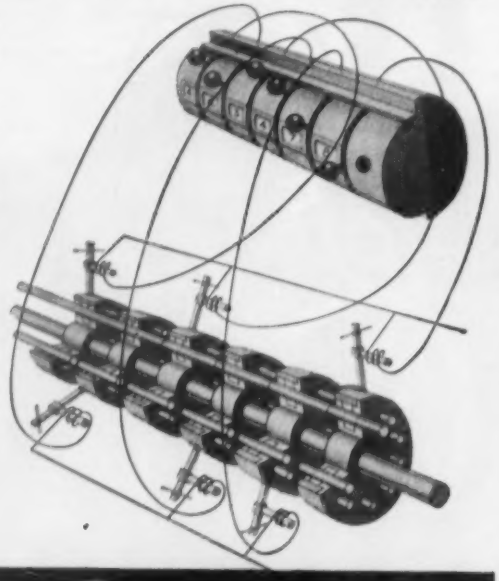

NEW!

Automatic Punch Card control completely eliminates possibility of human error...

...keeps settings for job on "automatic memory" file whenever job is repeated!

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William E Cranston has been elected president of A J Lindemann & Hoverson Co, Milwaukee appliance manufacturing company, a subsidiary of Norris Thermador Corp. He replaces **Eugene A Lindemann** who has resigned to establish a management consulting firm. Mr Cranston will continue to serve as president of Thermador Electrical Manufacturing Co, and first vice president of Norris-Thermador. **Howard N Kyser,** formerly general manager of Studebaker-Packard Corp's Los Angeles Plant, has been named vice president and general manager of Lindemann & Hoverson.

Harold H Gillespie, assistant general manaper of the Barden Corp, Danbury, Conn, has been named a vice president of the company. **Emil J Karkut,** factory manager, has also been named to a vice presidency.

Nicholas M Esposito, formerly production manager of Axelson Manufacturing Co's aircraft division, has joined H W Loud Machine Works, Pomona, Calif, as production manager.

Paul K Dubin, formerly mechanical plant engineer at Wilbur B Driver Co, Newark, NJ, has been appointed general works manager of Ulbrich Stainless Steels, Inc, Wallingford, Conn.

Roger Byrnes has been appointed midwestern district manager for Adamas Carbide Corp. Mr Byrnes, headquartered in Chicago, has been serving as manager of steel and nonferrous metal specialty sales.

Herbert von Wolff has been named vice president and general sales manager of Shalco Engineering Corp, Palo Alto, Calif.

William R Huguenin has been elected president of Hudson-Sharp Machine Co, Green Bay, Wis, manufacturer of wrapping machinery and equipment.

M E Dorman has been appointed manager of dealer and accessory sales for E W Bliss Co's Die Supply Division. He served previously as manager of purchases for the Hastings (Mich) Division.

Elmore H Broadhurst, works manager of the Titusville, Penna, plant of the Universal-Cyclops Steel Corp, has been named general manager of the Cyclops Division.

Working in the dark on TITANIUM MACHINING?

. . . THESE RECOMMENDED FEEDS AND SPEEDS FROM ADAMAS WILL HELP END YOUR DIFFICULTIES!

● Now your problems in machining titanium can be considerably lessened with these valuable facts and figures tabulated from *actual production runs* by several of the East Coast's largest aircraft and engine producers.

Choice of ADAMAS carbide for these titanium jobs was determined through pre-testing against the grades of three other leading carbide producers. Against this stiff competition, ADAMAS outperformed all other grades by *4 or 5 to 1!*

If you're already machining titanium or planning to, be sure to specify —

ADAMAS Grade BB for improved performance in heavy roughing and scale cuts.

ADAMAS Grade B, the ideal grade for general machining and semi-roughing.

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Since the proof of the carbide is in the cutting and not the advertising, don't read our claims—test them! Plan a test of ADAMAS' grades for titanium today!

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(For machining commercially pure titanium, type TI-75A, double speeds.)

	Scaly Forgings	No scale semi-roughing	Finish turning, boring & facing	Milling
Grade of Carbide	ADAMAS Grade BB†	ADAMAS Grade B	ADAMAS Grade A	ADAMAS Grade A
SFPM	50	150 - 200	300	350
Feed	.010 - .020	.010 - .020	.005 - .010	.003 per tooth
Depth of Cut	.250 - .500	.250	.015 - .032	

HELPFUL "TIPS"

How To Eliminate Vibration

To end tool vibration, use as large a shank size as possible on the tool. For severe roughing or scaly cuts use a high lead angle. Another "tip" is to hone a 45° land on the cutting edge approximately .005" to .010" wide . . . or reduce feed.

What To Do About Scale or Oxide

In machining titanium forgings covered with scale or oxide, use as large a radius as possible on your tool. This radius, however, must be kept below the point where vibration will be encountered.

* These figures represent approximate starting points and should be adjusted to your own machines and set up conditions.

† Figures on ADAMAS Grade BB represent a rough face front flange operation of 6Al Titanium Alloy on a Bullard VTL machine. The size of the material was:

Diameter—17⅓" Length of cut—5"

ADAMAS Grade BB delivered 12-15 pieces per grind. Figures on Grades A & B available upon request.

TEST WITHOUT OBLIGATION! For an actual machine test or detailed titanium machining literature, contact: Technical Service Div., ADAMAS Carbide Corp., Dept. 321, Kenilworth, N. J.

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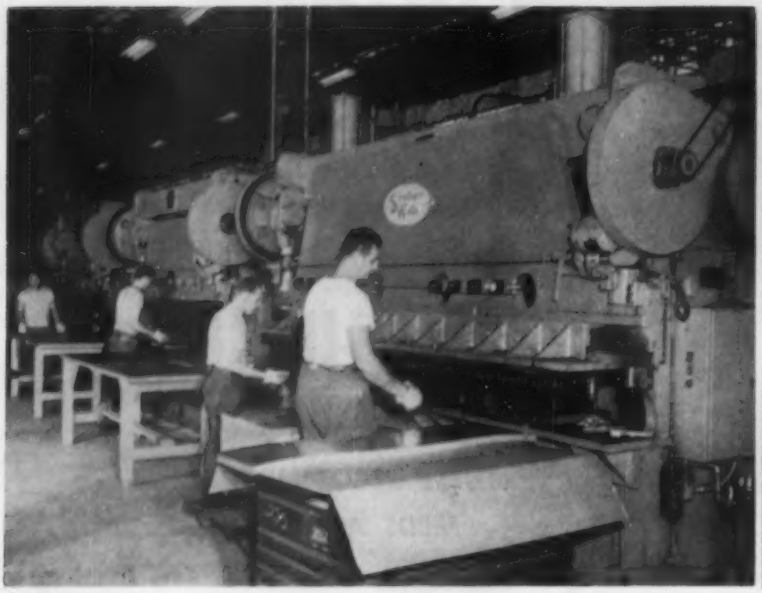


What's New . . . in Presswork?

Look for AM's 1957 Production Planbook

- **How much will modern production equipment increase *your* output?**
- **What can close-tolerance molding and casting do for you?**
- **Who's had success with automated press lines?**

NEW YORK — Subscribers forming metals in their shops will find new and profitable production ideas in Section D of AM's 1957 Production Planbook and Buyer's Guide Issue, due for mailing Mid-November, 1956. Presswork, Molding and Casting "Nuggets"—the essence of production ideas and techniques on these topics published throughout the year in American Machinist—will appear in Section D.

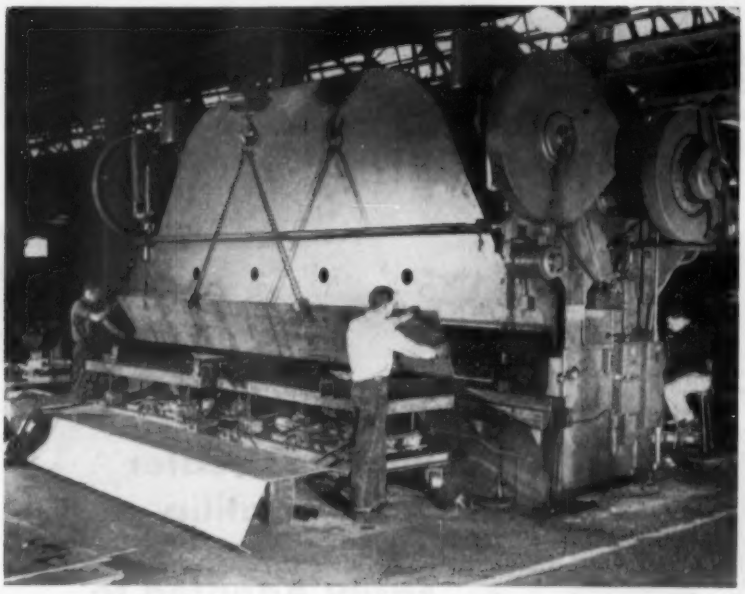
New methods of forming metals of all kinds into desired shapes, whether simple or complex; the production equipment required; new die-casting ideas; developments in molding; necessary accessories and tools; and the central ideas covering other metal-forming techniques, with issue date and page number to simplify reference for subscribers wanting more specific details, drawings, diagrams and illustrations will be the main feature of the section.

Such "How-to-do-it" articles as, "How to Work Titanium and Its Alloys," "14 Steps to Die Design," "How to Work Super Alloys," and many others which appeared in AM during the year will be cited. Sample Presswork, Molding and Casting "Nuggets" to be found in Section D:

Jumping jaws—spring-loaded quick-clamp jaws that hold the blank just above the dies—are the secret of new titanium forming method in drop hammer. They transmit current to resistance-heat the part in the press, go down with the blow, then spring back so practically no heat is lost before or during forming. Current is cut off as hammer drops. AM—Nov 7 '55, p113

Charges for injection molding are weighed automatically before being fed into heating chamber. This improves surface finish, decreases cycle time, and uses raw material more efficiently. AM—April 9 '56, p149

Cost reduction of 60% and weight reduction of 30% was achieved by



Molding? Casting?

and Buyer's Guide Issue . . . Due Mid-November 1956

casting alloy-iron motor endbell by shell molding. All rough machining was eliminated, shaft hole required only reaming to remove 0.005 in. of stock, joint ring required only precision boring to remove 0.015 in. of stock. General tolerances were held within ±0.002 in. AM—Oct 10 '55, p137

Die-casting tolerances are held to ±0.005 in. across parting lines, linear dimensions to ±0.0015 in., as compared to conventional tolerances of ±0.014 and 0.003 in. Material is a zinc alloy with high strength and malleability. Precision dies and high clamping pressures help maintain accuracy, reduce parting lines. AM —April 9 '56, p138

"Where-to-Buy-It" Buyer's Guide

A new feature of the issue will be an authoritative, complete Metalworking Buyer's Guide listing nearly 7000 sources of supply under 1400-odd headings—a "Where-to-Buy-It" reference for the production equipment, materials, parts and supplies used daily by Metalworking plants.

Complete Metalworking Reference Issue

As planned, *AM's* 1957 Production Planbook and Buyer's Guide Issue will provide *AM's* subscribers with Metalworking's only single-volume source of "How-to-do-it" production "Nuggets" covering management and personnel; machining; tooling; presswork, molding, casting; inspection, testing, quality control; assembly, heat-treat; materials, components; materials handling, services; and production planning along with Developments to Watch in '57 —challenging checklists; and "Manufacturers Free Literature" lists—all Classified by section. It all adds up to a fact-filled production reference issue whose year round usefulness is enhanced by thumb-indexing 10 of the 11 sections; flat-opening binding and subscriber-oriented classification of content.

1957 OUTLOOK

MANAGEMENT, PERSONNEL A

MACHINING B

TOOLING C

PRESSWORKING, MOLDING, CASTING D

INSPECTION, TESTING, QUALITY CONTROL E

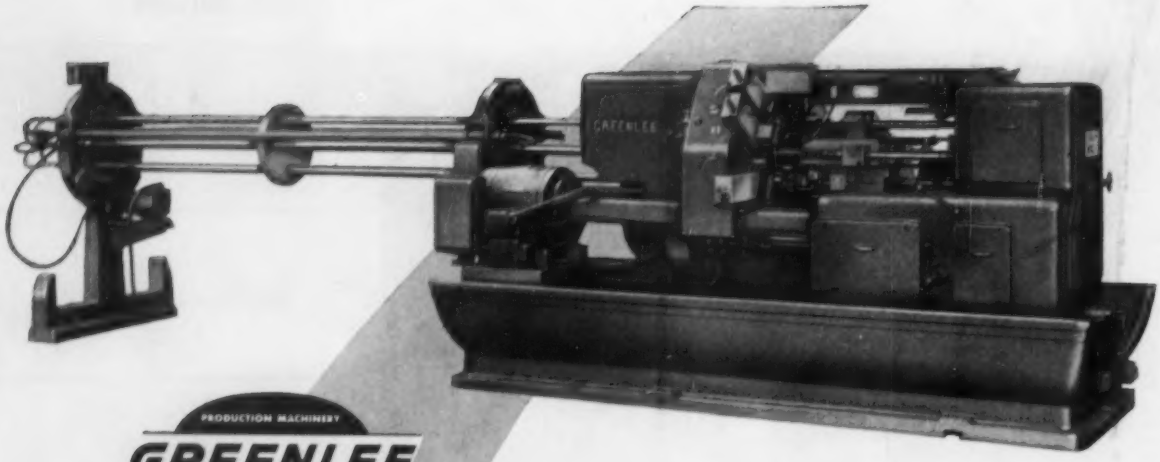
ASSEMBLY, HEAT-TREAT, FINISHING, (ASSEMBLY INCLUDES WELDING & PORTABLE TOOLS) F

MATERIALS, COMPONENTS G

MATERIALS HANDLING, SERVICES H

PRIZE IDEAS, REBUILT EQUIPMENT I

BUYER'S GUIDE J



PRODUCTION MACHINERY

GREENLEE

AIR-FEED AUTOMATIC

- **Permits Greater Job Versatility**
- **Easily Adapted to Multiple Feedouts**
- **Provides Longer Stock Feedout**
- **Eliminates Stock Scoring**
- **Reduces Stock Reel Noise**
- **Eliminates Stock Pushers**
- **Eliminates Feedout Cams**

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY

GREENLEE

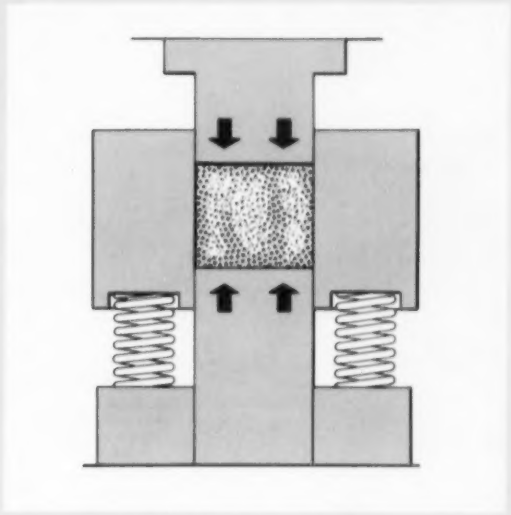
1740 MASON AVE.

Rockford, Illinois

KNOW YOUR CARBIDES . . . No. 1 IN A SERIES

How HYDROSTATIC IMPACTING* Gives You Better, More Dependable Carbide

HYDROSTATIC IMPACTING
(Valenite Method)



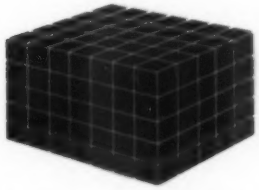
MECHANICAL PRESSING
(Conventional Method)

Milled powder is placed in a latex bag and roughly compacted into a billet. The bag is suspended in liquid in a sealed "pressure bomb." Repeated, enormous surges of pressure compact the powder into a dense, solid billet.

Air is evacuated from the bag before pressing. Residual air works out. No contaminating oxygen remains within the material.

Unit pressures are so high that the resulting billet is strong and hard. It is ready for machining into desired carbide shapes without pre-sintering or further processing.

Pressure is exactly equal in all directions. Pressure surges applied over a long period break down "bridging effects" between particles. Powder compresses to maximum density throughout. The billet is equally strong in all directions; sintering shrinkage is always uniform. Tolerances can be held closely.



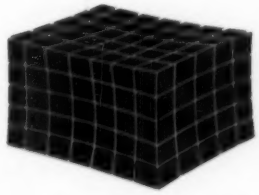
A scored billet formed by hydrostatic impacting looks like this after sintering.

Loose carbide powder is poured into a die in a mechanical or hydraulic press and is squeezed to form a billet. Compacting pressure varies with the surface area of the die and over the billet in areas of unequal fill.

Air entrapped within the loose, fluffy powder remains to cause laminations and other quality-reducing difficulties.

Unit pressures are necessarily low. The billet is weak and crumbles easily. It must be pre-sintered, or half-fired, before it can be handled. The ideal sintering cycle for highest quality can not be used.

No pressure is applied from the sides so the billet is stronger in one direction than another. It is impossible to fill the die cavity evenly and the billet varies in density throughout. Shrinkage in sintering is not uniform; tolerances must be very loose.



A scored billet of mechanically-pressed carbide looks like this after sintering.

***This new method (one of four VALENITE advances) is the key to wider use of money-saving preformed carbides, better all-around performance**

VALENITE
METALS CORPORATION

Box 205, Royal Oak, Michigan

See how to cut your carbide costs on following page.

The above preformed tungsten carbide parts (shown unfinished) required little work after sintering.

You can save time and money by using preformed carbide parts*

**. . . Valenite carbide preforms reach you faster —require far less finishing before they go to work!*

Here's Why . . .

1. Methods like Hydrostatic Impacting (see preceding page) enable Valenite to give you closer tolerances. You cut grinding and finishing time and expensive diamond wheel usage

2. Through Valenite's advanced production techniques, you get premium-grade carbides (and premium performance) at no increase in price over regular carbides

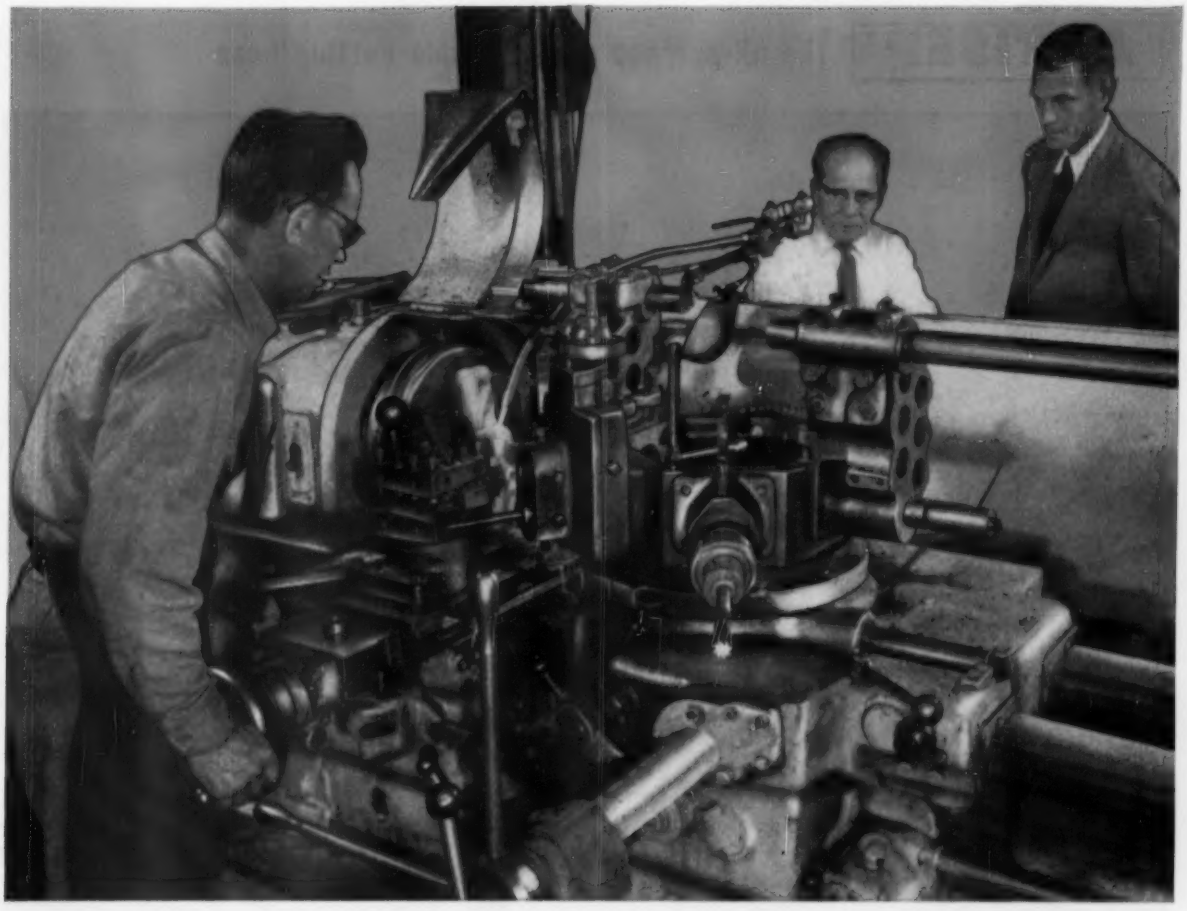
3. At the new Valenite plant, your preformed carbide parts go into production at once — without red tape delays in the office

4. Valenite maintains a staff of specialists in carbide preforming. Their assistance will save you money, give you improved on-the-job carbide performance

Maybe you can save money *right now* on your carbide preforms, or profitably use preforms in place of modified standards. Why not send your prints to Valenite for study, recommendations and a quotation? Or ask for your Valenite field man to call.

Write to:
TECHNICAL SERVICES DEPARTMENT

VALENITE
METALS CORPORATION
Box 205, Royal Oak, Michigan



Shop Superintendent Bonnafe and Gulf Sales Engineer G. R. Burnham check on performance of Gulfcut 51A as turret lathe turns a stainless steel drive roll for a wire belt.

"Gulfcut gives us longer tool life,"

says Joseph Bonnafe, Shop Superintendent, J. W. Greer Company, Wilmington, Mass.

Shop superintendents like Mr. Bonnafe, engineers and machine tool operators ***know*** that production can be improved and costs lowered through the use of cutting oils designed specifically for the job. And, they know they can get the right oil for *every* job from the complete line of Gulfcut Oils. Reports like these come from the field every day:

From an aluminum plant: ". . . stepped up production of aluminum caps 25%, increased tool life well over 100%, and we're getting better threads."

From a plant working tough titanium-alloy stainless steels: ". . . results were phenomenal. Tool life increased over 40% and surface finish was improved 43 microns."

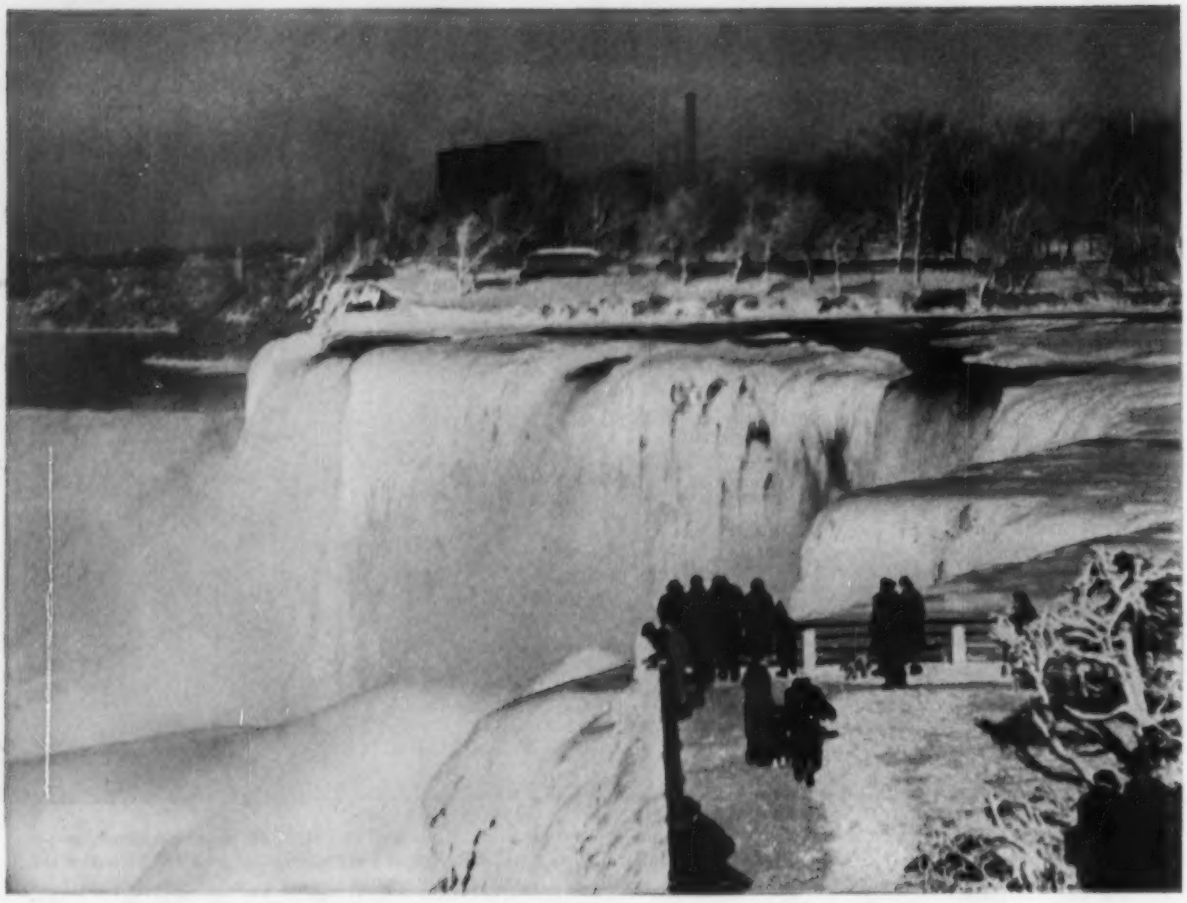
Your Gulf Sales Engineer can pin-point your cutting oil requirements—can help you improve shop efficiency through the use of the most suitable cutting oils for your needs. Contact him today at your nearest Gulf Office.

GULF OIL CORPORATION
GULF REFINING COMPANY
1822 Gulf Building
Pittsburgh 30, Pennsylvania

GULF

THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

ANTISEP the all-purpose water-soluble cutting base



Water is the fastest, cheapest coolant in the world

ANTISEP makes water work wonders for you!

In machining, water will carry heat away from tools and work much faster than any straight cutting oil. But water lacks other needed properties. That's where ANTISEP works its magic.

As little as 3% of this fortified all-purpose base added to water produces the finest cutting fluid money can buy. It combines high film strength with extra lubricity and anti-welding properties. Its antiseptic qualities protect workers and eliminate obnoxious odors from the shop. At an end cost of 8c per gallon in the machine, ANTISEP gives you longer tool life, higher quality work, and stepped-up production.

Ask to see the proof of ANTISEP's performance in metalworking plants—the Houghton Man has plenty to show you. A test can be arranged at your convenience. Just write to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

ANTISEP all-purpose cutting base

...a product of

E. F. HOUGHTON & CO.

PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO

Ready to give you on-the-job service . . .

NEW

No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

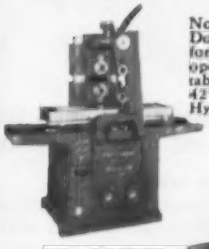
No. 3-36
HYDRAULIC MILLING MACHINE

Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for *larger size work!*

Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

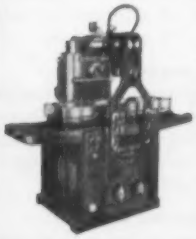
Kent-Owens Machine Co., Toledo, O.

Simple . . . Rugged . . . Efficient



No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.

No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 1-M . . . Hand feed to table and head . . . 25" x 9" table . . . 12" table travel . . . head counter-balance is adjustable.

Call on

KENT-OWENS
for MILLING MACHINES

KENT-OWENS REPRESENTATIVES

BOSTON
General Machinery Corp.

BUFFALO
Bentley-Ackerman Mach'y Co.

CHICAGO
Van Keuren Mach'y Company

DALLAS
Hoover Machine Tool Co.

DAYTON
C. H. Gardner Mach'y Co.

DETROIT
A. C. Hollenbeck Mach'y Co.

FT. WAYNE
Quick Machinery Co.

GRAND RAPIDS
Joseph Monahan

HAMILTON, ONT.
E. R. Fisher Mach'y Company

HARTFORD
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HOUSTON
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MICRO precision switches

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN

HONEYWELL

CUT COSTS!

Make your plant more automatic and more productive

Send for Catalog #83 for information on MICRO SWITCH "Industrial Enclosed Switches"

• For years plant operating men have been putting new life into old machines—at low cost—by installing MICRO SWITCH precision switches to make them more automatic and more productive.

They do so by using MICRO SWITCH switches as limits, interlocks and safeties on almost every conceivable type of plant equipment. Special switches are available for use in explosive atmospheres or other hazardous locations. A wide variety of circuit arrangements, actuators and enclosures meets specific operating requirements.

Plant superintendents, electricians and maintenance men have found MICRO SWITCH products invaluable in making present equipment more productive. Full stocks of switches are readily available from authorized distributors who are as close as your telephone. Look under "Switches, Electric" in the Yellow Pages.

ANY OF THESE CATALOGS WILL BE SENT ON REQUEST

62a • "Basic Switches"	82 • "Basic and Enclosed Switches"
73b • "Toggle Switches"	83a • "Industrial Enclosed Switches"
74b • "V3 Switches"	90a • "Mercury Switches"
75a • "Subminiature Switches"	101b • "Switches for Industry"

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

HOW SWITCHES HAVE BEEN USED TO SAVE TIME AND MATERIALS

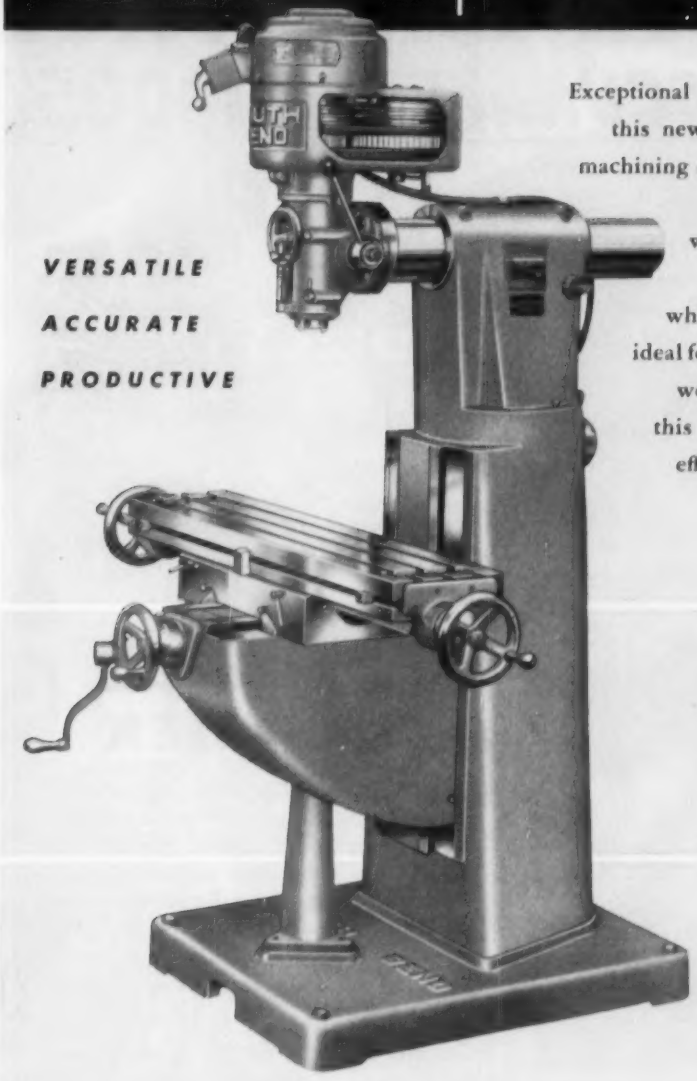
Stops needle breakage:
Switch stops knitting machine when slack develops in wire. Mechanism starts automatically when slack is relieved.

Protects personnel:
Explosion-proof switch installed on filter system permits operation of equipment only if vent valve is closed.

Prevents conveyor pile-up:
Two switches wired in series, each operating independently as sugar bag passes. When bags pile up, both switches are operated and conveyor stops.

Counts revolutions of mixer:
Switch connected with counting device is actuated by each complete revolution of mixing drum, recording number of revolutions at convenient point for operator.

New SOUTH BEND VERTICAL MILLING MACHINE

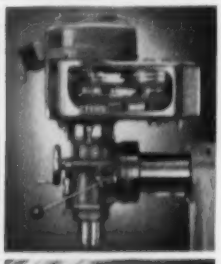


VERSATILE

ACCURATE

PRODUCTIVE

Exceptional versatility, accuracy and speed give this new milling machine the ability to keep machining costs low. Its simplicity of design provides ease of accessibility and set-up which simplify operation and job change-overs. The wide variety of jobs which it can handle makes this machine ideal for toolroom, production and maintenance work. It will pay you to find out how this new milling machine can give you greater efficiency—write for information.



LO-LOSS spindle drive. Precision ground and fitted quill.

Positive action controls with large, adjustable, graduated collars.

Manual table feed standard equipment.

Power longitudinal table feed and automatic quill feed optional.

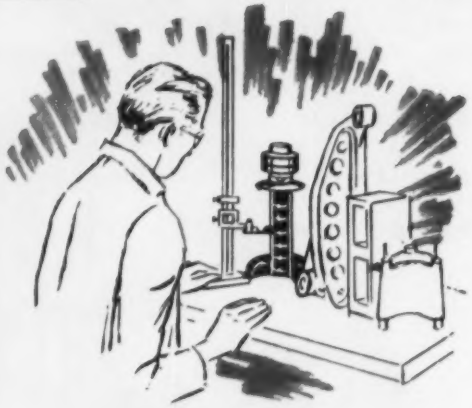
SPECIFICATIONS

Longitudinal table travel	20″ or 30″
Cross feed	9½″
Spindle to table (max.)	20″
Spindle to column (max.)	20″
Ram travel	15″
Spindle speeds (8) 135 to 3750 r.p.m.	
Spindle travel	4″
Head rotation	360°

SOUTH BEND 1906 50th ANNIVERSARY 1956

SOUTH BEND LATHE 425 East Madison Street South Bend 22, Indiana

This Cadillac 6" PLA-CHEK GAGE *IS ACCURATE* to .00005"



Cadillac PLA-CHEK

For checking smaller jobs, gages, tools and dies, this portable 6" Cadillac PLA-CHEK Gage is accurate to .00005". It can easily be checked in and out of your tool crib to be used on the surface plate or at the machine. It is completely self-contained and extremely simple in operation. Speeds inspections from minutes to seconds.

Capacity of the 6" PLA-CHEK model can be increased by the addition of a 6" riser without affecting accuracy or sacrificing portability. Send coupon TODAY for complete details!

MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
P. O. BOX 3806, DETROIT 5, MICHIGAN

Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

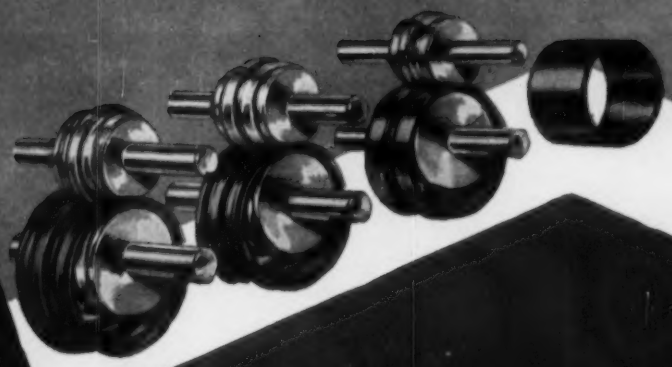
Name_____

Company_____

Address_____

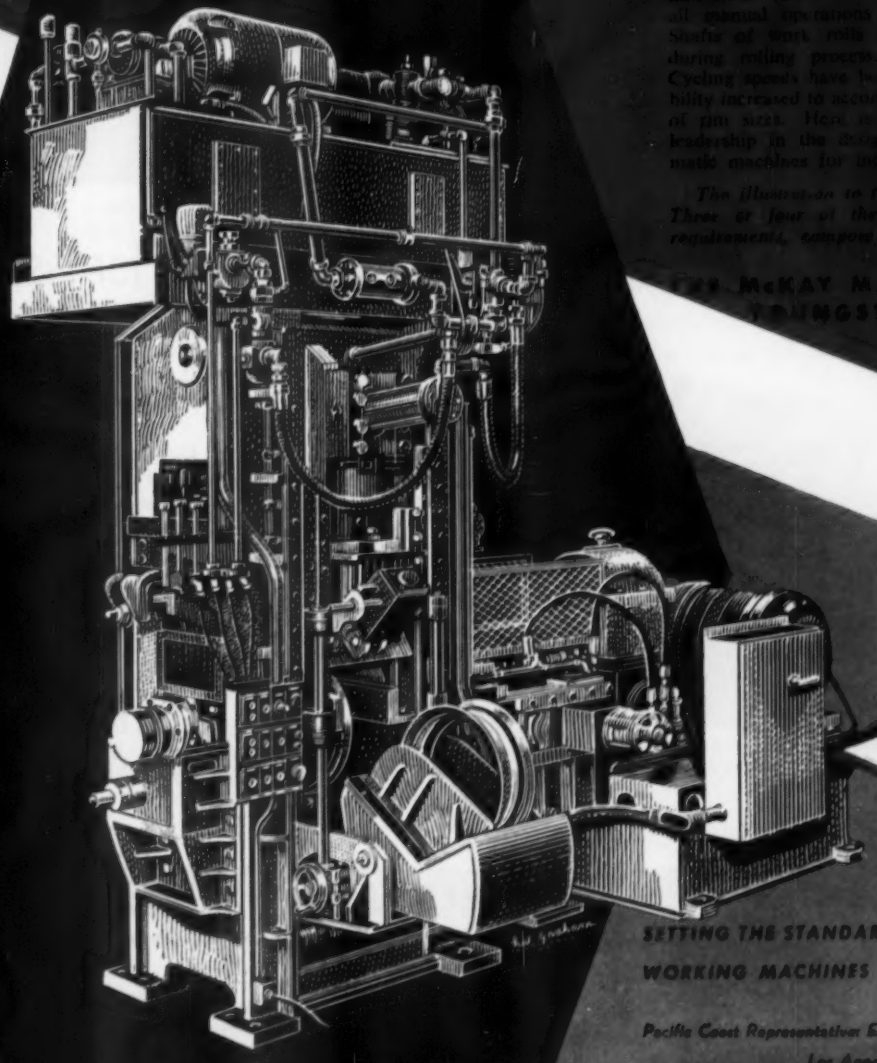
City_____ Zone____ State_____

Cadillac
GAGE COMPANY
P. O. BOX 3806 • DETROIT 5, MICH.



McKay's

Automatic Rim Roller Line...



McKay Automatic Rim Rolling Mills represent the latest development in equipment in this specialized field. From the first roll to the final part, all manual operations have now been eliminated. Shafts of short rolls are supported at both ends during rolling process, eliminating roll deflection. Cycling speeds have been stepped up and line flexibility increased to accommodate an extra wide range of rim sizes. Here is another example of McKAY leadership in the design and construction of automatic machines for industry.

The illustration to the left is of one roll station. Three or four of these units, depending on the requirements, compose our entire line.

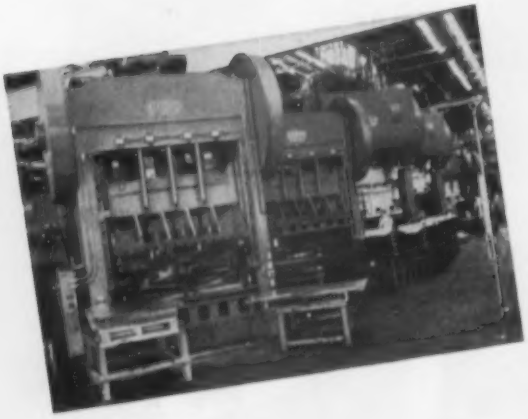
FOR McKAY MACHINE COMPANY
YOUNGSTOWN, OHIO

McK

SETTING THE STANDARDS OF QUALITY IN METAL WORKING MACHINES FOR TWO GENERATIONS

Pacific Coast Representative ENGEN INDUSTRIAL COMPANY
Los Angeles, California

new CLEVELAND Presses give you better stampings for less.



Chances are that your production lines are operating at full capacity. That's why it's most important to carefully check your present Press equipment. Worn, inefficient Presses are wasting your profits.

In the ever widening field of pressed metal products, new Cleveland Presses are used to advantage by cost conscious manufacturers. They've found their investment in new Presses is soon repaid by more accurate, dependable and economical production.

Whether you need one press or a complete battery, you'll find there's just the right Cleveland Press to keep your company in a competitive, profitable position; Cleveland Presses are built in a complete range of types and sizes, from small Open Back Inclinables to large Underdrives. All offer outstanding efficiency.

Whatever your needs may be, "why settle for less than a Cleveland Press." Be sure to get complete information on the (patented) Cleveland Drum Type Air Friction Clutch with spring loaded Brake. It reduces down-time. Write or call today.

THE CLEVELAND PUNCH & SHEAR WORKS CO.

Established 1880

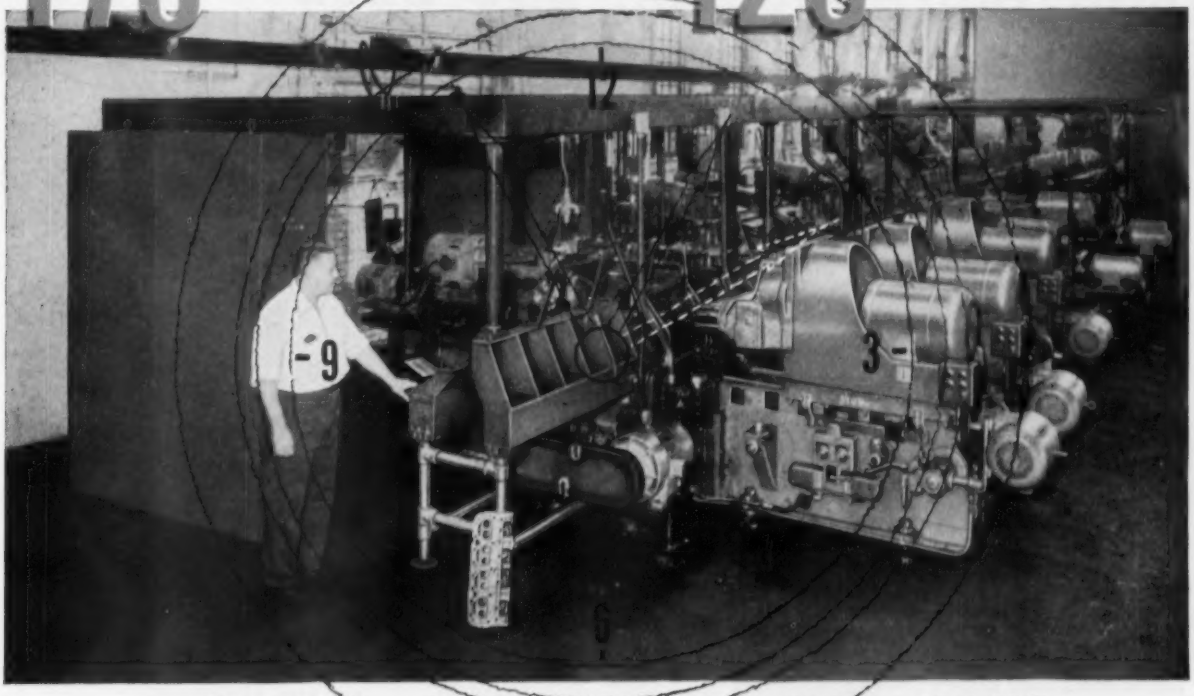
POWER PRESSES – FABRICATING TOOLS

E. 40th & St. Clair Avenue, Cleveland 14, Ohio

Offices at: NEW YORK • CHICAGO • DETROIT
PHILADELPHIA • E. LANSING

CITY FOUNDRY DIVISION - SMALL TOOL DEPARTMENT

175 Machine Operations on 128 Cylinder Heads



= 22,400 OPERATIONS PER HOUR

Functioning automatically in TIMED SEQUENCE, this BAUSH TRANSFER LINE is producing accurately machined parts at low cost for a leading automotive manufacturer's new V-8 engine.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

This 21 Station Baush Transfer Line consists of:

1 Loading; 13 Working; 2 Roll-over; and 5 Idle Stations having
12 Vertical Angular Model "S" Mechanical Leadscrew Units —
4 Horizontal Model "S" Mechanical Leadscrew Units —
1 Vertical Model "S" Mechanical Leadscrew Unit —
4 Horizontal 30F-18 Hydraulic Units —
1 Vertical Hydraulic Unit mounted on hydraulic horizontal slide —
2 Vertical Angle Hydraulic Checking Units —
22 Fixed Center Heads having a total of 175 spindles —
6 Transfer Power Units —
2 Roll-over Fixtures —
6 3-position Transfer Sections with Arch Fixture and Bushing Plates.

OPERATIONS:

Mill — Drill — Ream — Chamfer — Counterbore and Countersink — Spotface and Tap.

PRODUCTION:

Approximately 128 Cylinder Heads per hour at 100% efficiency.

Here are the world's finest power cylinders

...competitively priced!

This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

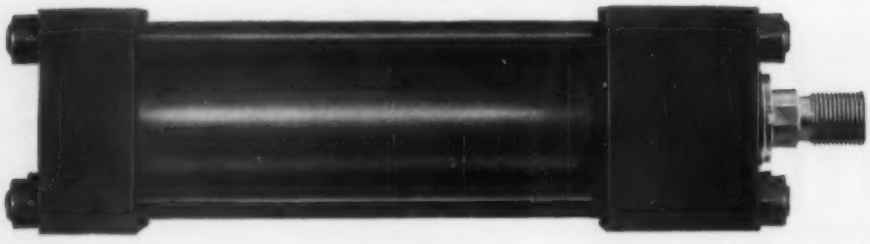
He'll show you design features that other cylinders simply do not have... extra quality workmanship at critical points that pays off in longer life ...accessibility that simplifies their infrequent maintenance. And when he talks price and delivery, you will find these better features cost you no more, can often be delivered sooner.

We think you'll agree that it pays to standardize on Hannifin cylinders.

AIR AND HYDRAULIC

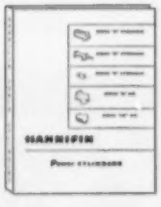
HANNIFIN

POWER CYLINDERS



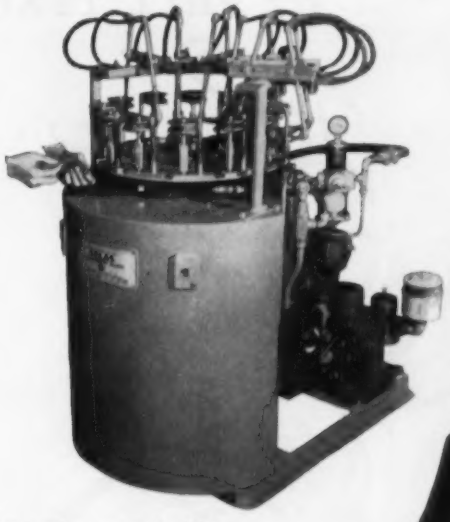
COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 517 S. Wolf Road, Des Plaines, Ill.



400 CRAFTSMAN SOCKET WRENCHES
Selas-brazed and hardened per hour

Fast, sure, low cost Selas brazing permits joining simplified *socket forging and turned shank* in lieu of a more complex *one-piece forging*. Preplaced, preformed filler ring produces optimum fillet, full strength in every joint.



Space-saving automatic Selas machine does the brazing; simplicity of operation permits use of unskilled labor. Additional savings result from use of accurately patterned brazing heat to harden the AISI 4041 steel wrench socket. Fuel cost only 2½c per hr.

This high quality CRAFTSMAN nut driver is sold by Sears for approximately 79c (set of 7 is about $4.98, varying by region). Selas automatic brazing maintains quality while achieving the required production economy.

High brazing skills are built into this automatic Selas machine through controlled combustion and accurate flame geometry. Specially-designed fixtures adapt to three shank diameters and nine socket sizes. The result is high volume, dependable brazing at lowest cost.

In addition to LOW UNIT COST you can expect these other advantages with Selas automatic brazing: √ Simple labor skills √ Speed √ Reproducible uniformity √ Wide variety of base and filler metals readily handled √ Single responsibility with Selas designing, building and servicing your machine.

Send for Bulletin No. 310 "Production Brazing and Soldering" and reprint "Mechanized Heating Puts Brazing on the Production Line."

SELAS
CORPORATION OF AMERICA
DRESHER, PENNSYLVANIA

Heat and Fluid Processing Engineers

DEVELOPMENT • DESIGN • CONSTRUCTION

KEEP IT CLEAN...

by Phil Tration

Electro-Staynew Mist Collector

The uses for Dollinger Filters are truly "elephantine" . . . any liquid, gas, or air can be efficiently and economically handled by them.

To assure clean air in machine shops, Dollinger makes the Electro-Staynew Mist Collector illustrated at the right. It provides a self-contained ventilating system for individual machine tools. Removes oil, smoke, grit, and chips from the air, and returns clean air to shop. Saves you hundreds of dollars in building maintenance and protects the health of your employees.

Whatever your filtration problems, why not talk them over with a Dollinger engineer . . . call today, or write for Bulletin 420 which fully describes the Mist Collector. Dollinger Corporation, 93 Centre Park, Rochester 3, N. Y.

DOLLINGER
STAYNEW FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

THE *first* FINISHED PIECE AND THE *last*...

tells the COST-CUTTING story of Chase® FREE-CUTTING Brass Rod!

Match-up piece number two, two-thousand or two-hundred-thousand with the *first* production piece machined from Chase Free-Cutting Brass Rod. They'll be identical twins! Same fine, smooth finish—same micrometer-perfect dimensions—same absolute duplicates in performance.

What's more, fabrication costs stay at rock-bottom all through the production run! The unsurpassed machining qualities of Chase Free-Cutting Brass Rod permit minimum tool rake angles, fewer dressings, higher cutting speeds and heaviest feeds. All without sacrificing quality or precision of the finished piece.

This rod comes to you precisely alloyed and tempered. Standard mill lengths are stocked in many different cross-sections for quick delivery from Chase Warehouses. Special shapes that *save even more* machining time can be made to order. Write, wire or phone today!

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The Most significant advance in a quarter Century of HEIGHT GAGE DESIGN
EASY READING 5-1/2" LONG VERNIER
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TRIANGULAR SCALE BEAM for Superior Strength and Rigidity, preventing sway and vibration.
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PRODUCTION METHODS at GRAFLEX

Here are details of unique precision production methods at Graflex, Inc., Rochester. An *American Machinist* Special Report. 20 pages, illustrated, 25 cents a copy.

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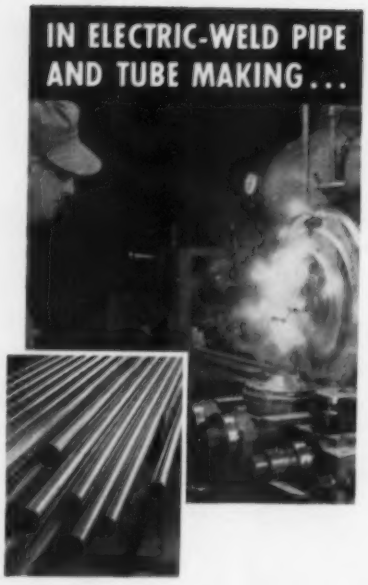

Now...Free New SLIDE GUIDE

With this new and different slide rule type comparison chart you can check 21 essential specifications of 8 leading heavy duty milling machines. Compare their capacity, speeds, feeds, etc., at a glance.

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Yoder Leads the Way

to higher speeds and quality at lower cost

In the short period from 1938 to 1955, the production of electric welded pipe and tubing grew from 269,000 tons to over 3,000,000 tons. This phenomenal rate of growth—over two and one-half times faster than that of the pipe and tube making industry as a whole—to a large extent resulted from a series of important improvements in tube mill design, all introduced by Yoder.

First came the Yoder rotating welding transformer, in 1938. The economic and other benefits conferred by this epoch making innovation were further augmented by other technological advances scored by Yoder in the years that followed. The result was that electric-weld pipe and tube making became the child prodigy of the fast growing pipe and tube making industry.

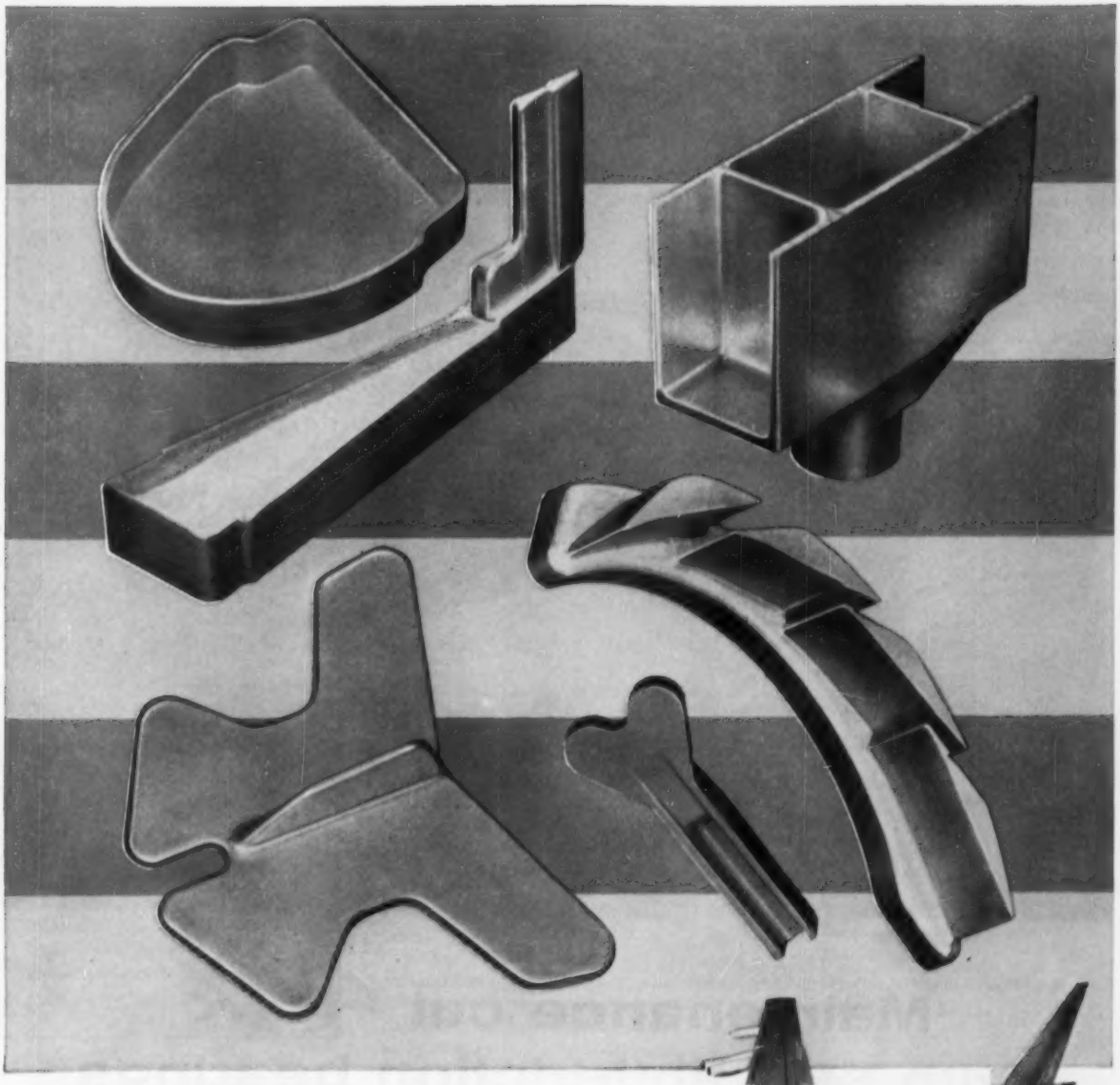
Latest of these developments is the induction welding at high speeds of *aluminum, magnesium, brass, nickel, monel, and other non-ferrous metals and alloys.* This process is especially economical for making light and medium gauge tubes in sizes up to 8 in. diameter.

More complete information may be had by asking for any of the following publications:

- ☐ Resistance-Weld Mills for Making Steel Tubing up to 4" diameter.
- ☐ Induction-Weld Mills for Making Non-ferrous Tubing.
- ☐ Resistance-Weld Mills for Steel Pipe up to 24" diameter.

THE YODER COMPANY
5519 Walworth Ave. • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING
ELECTRIC WELD TUBE MILLS



No-draft forgings by Kaiser Aluminum

KAISER ALUMINUM'S Erie plant has been successful in meeting its customers' ever-growing needs for no-draft forgings.

Shown on this page are a few of the many no-draft forgings produced by Kaiser Aluminum on *existing equipment* for the aircraft industry.

Additional equipment—especially designed for no-draft forgings—will soon be installed to greatly increase our capacity for these specialized forgings.

Kaiser Aluminum no-draft forgings give you the benefits of substantial cost savings through the elimination of machining, plus extremely light weight with high strength, close tolerances, and superior finish.

When you submit your aluminum forging inquiry to Kaiser Aluminum, our highly skilled engineering staff will evaluate the forging to determine its suitability as a no-draft forging.

For immediate service, call any Kaiser Aluminum sales office listed in your local telephone directory. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Building, Chicago 11, Illinois; *Executive Office*, Kaiser Building, Oakland 12, California.

Kaiser Aluminum

Maintenance cut 49% with SKF® anti-friction bearings

SKF "Triple-Seal" Pillow Blocks, used by an eastern limestone producer in pulverizing tube mills, have saved thousands of dollars since their installation in 1948.

In comparable operating periods, counter-shaft failures dropped from 11 to 2, bearing maintenance costs were cut 49%, production increased 70%, power savings averaged 10% to 20%.

Required to operate in a highly abrasive "snowstorm" of powdered limestone, these triple-sealed units continue to save money for the user. They will do the same for you.

For further information on how these remarkable "Triple-Seal" Pillow Blocks can be applied most effectively to your products, get in touch with your local **SKF** Sales Office. 7736

SKF

EVERY TYPE—EVERY USE

- *Ball Bearings*
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*Reg. U.S. Pat. Off. Tyson Bearing Corporation

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., 738 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

New 424-page Book Tells How You Can Produce Tools, Dies, Precision Parts the Modern Way...

"Holes, Contours and Surfaces" Just Published

EXCLUSIVE... 184 pages of Woodworth Hole Location Tables

"HC&S" includes a 184-page section of Woodworth Circular Tables which greatly simplify calculating rectangular coordinates for locating hole centers on a circular layout. There is a table for each pattern of holes, 3 to 100 inclusive. Unavailable elsewhere, these tables alone are worth more than the price of the book.

495 Photos and Drawings

"HC&S" features a multitude of close-up instructional photographs, working drawings and charts placed adjacent to text so that it can be followed photographically.

"Holes, Contours and Surfaces," just published by Moore, is the first comprehensive book that gives all the answers to metalworking's toughest problem: *the accurate locating and machining of holes, contours and surfaces.* It covers the many major developments in the field since 1946 when Moore's first book, "Precision Hole Location," was published. That book was so well received that it became a technical best-seller and is now out of print.

While "PHL" dealt only with jig boring and jig grinding of holes, this new, 424-page volume describes subsequent hole-location developments, covers contours and surfaces, and introduces the subject of linear form grinding. "HC&S" is a must for every toolmaker, jig borer operator, jig grinder operator, machinist, tool engineer, production engineer, machine buyer, machine builder, production executive, product designer, apprentice and student.

"HC&S Fills Urgent Need" .... Burnham Finney

Here's what Burnham Finney, distinguished editor of *American Machinist*, says about "HC&S": "Outstanding for its clarity of expression, its technical accuracy... fills an urgent need and should live long on the bookshelves and work benches of the American Metalworking Industry."

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8. Jig Grinding Principles & Applications
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Diesel Fuel Injector Parts Get Precision Flatness, Finish and Parallelity on Lapmasters®

. . . here's why and how

"John Crane" Lapmasters are taking over the highly critical and essential job of making diesel fuel injectors absolutely leak-proof—and doing it at a considerable reduction in cost over previous methods.

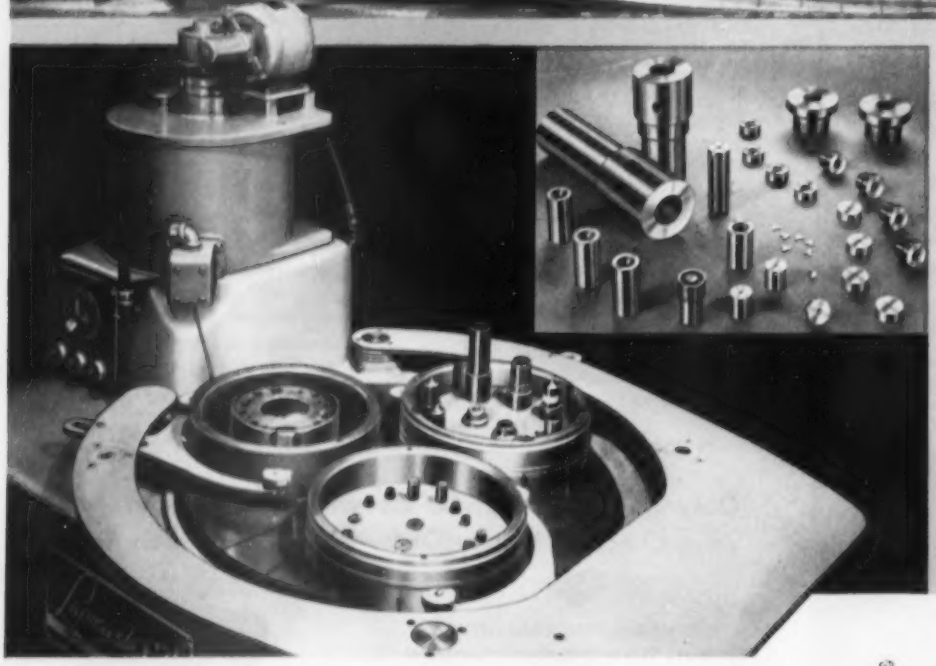
Both engine shops and injector manufacturers have found the Lapmaster a highly successful machine tool for obtaining the required flatness and finish on the mating surfaces of valve nozzle bodies, holders and spacers . . . have found they can run any combination of parts best suited to their production requirements . . . have reduced inspection and rework to the vanishing point.

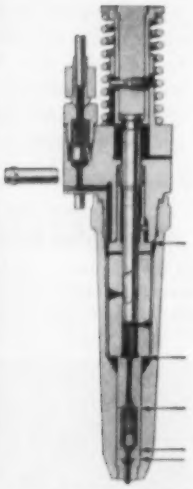
Lapmasters consistently produce flatness to less than one light band (11.6 millionth of an inch) surface finishes of 2 to 3 RMS on practically every kind of material including all ferrous metals, magnesium, aluminum, brass, carbon, ceramics and plastics.

There is a correct size Lapmaster for your requirement. Investigate the possibilities of this modern machine for your work.

FREE DATA

Send for these three booklets which describe in detail how to produce and measure precision flatness and finish.





ARROWS SHOW MATING SURFACES LAPPED

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6436 Oakton Street, Morton Grove, Illinois (Chicago Suburb) *In Canada: 617 Parkdale Ave., Hamilton, Ontario*

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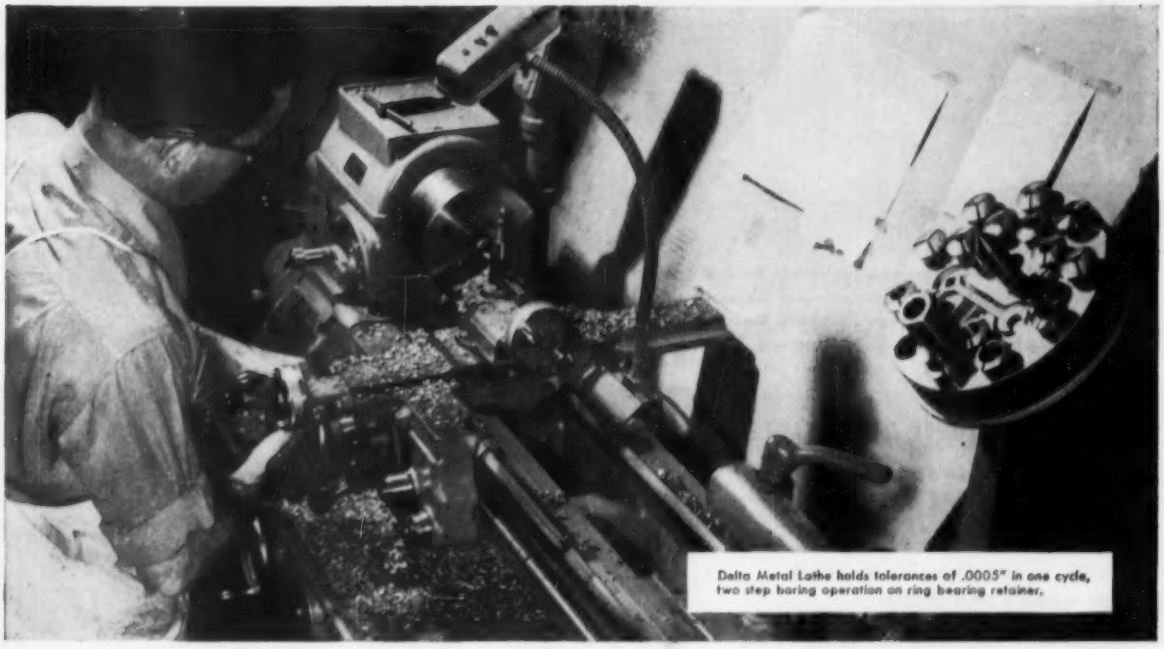
DELTA 11" metal lathe

makes heavier cuts faster than other more costly lathes tried by Carros & Hart Co., Bristol, Conn.



Delta Metal Lathe holds tolerances of .0005" in one cycle, two step boring operation on ring bearing retainer.

Donald S. Hart, Sales Manager, says:

"QUALITY CONTROL IMPORTANT—Turning out precision gears and specially designed tools and dies demands, in many cases, that tolerances of .0005" be held. Our Delta lathe meets these demands, gives us the exacting work we need.

"BEST LATHE OF ITS TYPE—In all kinds of metal, including steel, it makes heavier cuts faster than other more costly lathes we've used.

"SOUND INVESTMENT—This Delta lathe is a tremendous value for the money."

See the entire Delta 11" Metal Lathe line: 4 and 5-foot bed models—threaded spindle and tapered key drive spindle nose models—single or 3-phase motors and controls.

***NEW DELTA PRODUCTION ACCESSORIES**—Now, convert your engine lathe to an efficient production machine quickly, easily, at lowest cost!*

Compare Delta with any lathe of comparable size—or price—and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the yellow pages.

Send for All The Facts . . . Today!

Delta Power Tool Division, Rockwell Manufactering Co.
618K N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send Delta Industrial Catalog on entire Delta 11" Metal Lathe line.

☐ Please send name of my nearest Delta Dealer.

Name _____ Title _____

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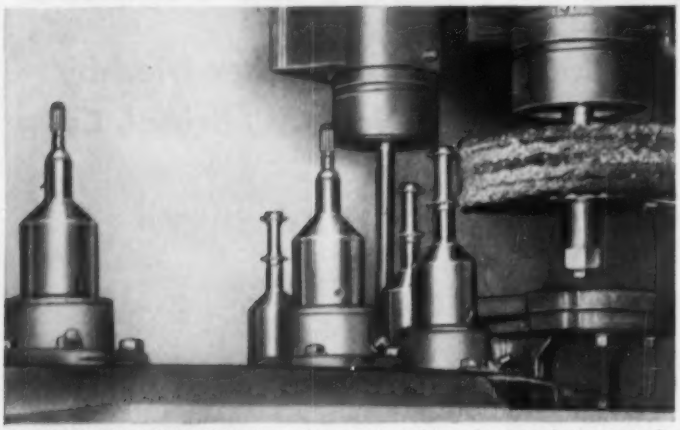
DELTA ROCKWELL

another product by **ROCKWELL**

Self-release, greater grip, automatic alignment of ERICKSON MANDRELS speed small to large part loading



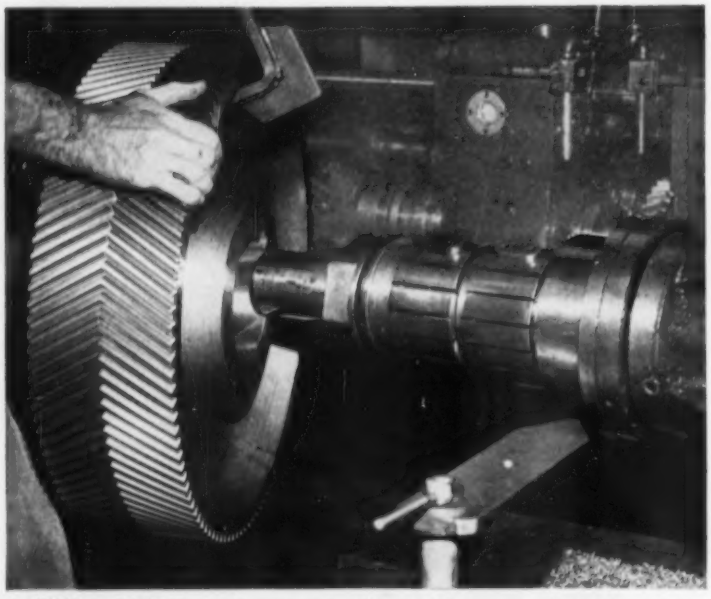
SMALL ERICKSON MANDRELS play a big part in holding down production costs for leading bicycle parts manufacturer. Here you can see how Erickson drawbar-operated, precision expanding mandrels speed wheel hub loading for buffing operation. Ease of operation and instantaneous release have greatly speeded this quantity production holding problem.

Regardless of size, Erickson precision expanding mandrels operate on Erickson's famous double-angle principle that not only assures guaranteed accuracy of .0005" T I R, but also makes mandrels self-releasing. They are available for air, hydraulic or manual operation. Special mandrel sleeves are designed to match various internal forms. AA-72

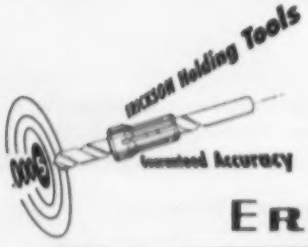
ERICKSON MANDREL ADVANTAGES

- Instantaneous self-release greatly speeds loading and unloading
- Greater holding power because grip extends over entire sleeve length . . . stops wobble and chatter
- Guaranteed accuracy of .0005" T I R
- Each sleeve covers a range of 1/32"
- Sleeves are interchangeable on mandrels of same series

Are you bothered by a tough internal holding problem? Then let us prove that Erickson mandrels speed production for lower unit costs. Give us a call today or write for catalog K.



ERICKSON MANDRELS speed large part handling, too. See how easily this heavy shovel gear, 24 inches in diameter, is being loaded for gear cutting at the Alten Foundry and Machine Works, Inc., Lancaster, Ohio. Larger shovel gears up to 61 inches in diameter are handled just as easily. At Alten Foundry, using an Erickson mandrel, loading and automatic alignment require only 10 percent of the time required by plants using solid arbors and arbor presses. Even this large mandrel is self-releasing. Operator fatigue is practically eliminated.



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EXPANDING MANDRELS • SPECIAL HOLDING FIXTURES

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RUBBER-CUSHIONED
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Slower
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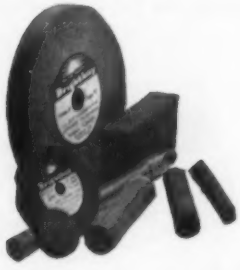
TIME SAVINGS FREQUENTLY 50%

BURRING, CLEANING, FINISHING, POLISHING—*IN ONE OPERATION*



Brightboy is made in wheels as well as in a full range of accessory products —rods, sticks and blocks— for machine and manual operations.

Investigate Brightboy's unique rubber-and-abrasive action, which you must see to believe! It has pioneered a completely new concept of finishing, widely broadening the scope of abrasive applications.

Readily available multi-use Brightboy stock grains and textures are job-matched to your work. In many instances they completely eliminate the expense and delay of ordering "specials".

Choose from the wide range of Brightboy abrasive grains in Silicon Carbide and Aluminum Oxide. Grains and textures range from extra fine to extra coarse—ALL in soft, firm and tough rubber binders.

Ask your dealer for Brightboy recommendations and for the Brightboy Catalog listing grains, textures, machine speeds and work suggestions. Write us if he cannot supply you, or on any problem in which finishing is involved.

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BRIGHTBOY INDUSTRIAL DIVISION • WELDON ROBERTS RUBBER CO. • 95 N. 13th St., Newark 7, N. J.

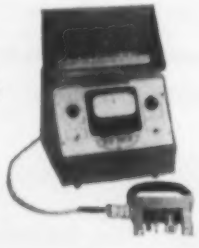
America's Pioneer Manufacturer of Rubber-Bonded Abrasives

You can't afford "mistaken identity" on your production line!

It's hard to believe that the wrong metals get into production so often, and even worse, into finished products. Yet the causes of such mistakes are usually very simple.

Errors are made in shipping or metal stocks are mis-identified. Errors occur in processing, too. Accidental mixing of hardened and unhardened parts of similar appearance is common.

No matter how sly their origin, these undetected situations inevitably get out of hand and into cost figures. Tools are damaged; production time is lost. Parts pile up in scrap, or worse, get by inspection and fail in the hands of the customer.



New Brush METAL MONITOR takes the guesswork out of metal identification.

Most plants are surprisingly susceptible to these cases of "mistaken identity" which cost millions of dollars every year. *But now these wastes can be eliminated!*

New Shop Tool Identifies Metals

Brush Electronics offers a new instrument, the Brush METAL MONITOR, which will detect variations from approved metal specifications at any stage of processing. It works on ferrous or non-ferrous metal, is nondestructive, won't mar finished surfaces. And it's portable, easy to use. Any worker can check any metal anywhere in the shop. The METAL MONITOR prevents losses due to the use of the wrong metals.

How It Works

Metal checks are easy to conduct. The METAL MONITOR probe is held momentarily on a sample of metal known to have the desired structure and composition and the operator obtains an immediate reading. He then holds the probe on the piece to be checked. If the reading is the same, the metal is the same . . . if the reading varies, it's the wrong metal.

Write for this introductory booklet on the new Brush METAL MONITOR now!

To get the complete facts about this fast, accurate instrument, send for your free copy of a brand-new booklet. It describes the Brush METAL MONITOR in detail, explains how it will save money for your company.

*T. M.

BRUSH ELECTRONICS COMPANY

3605 Perkins Avenue, Cleveland 14, Ohio

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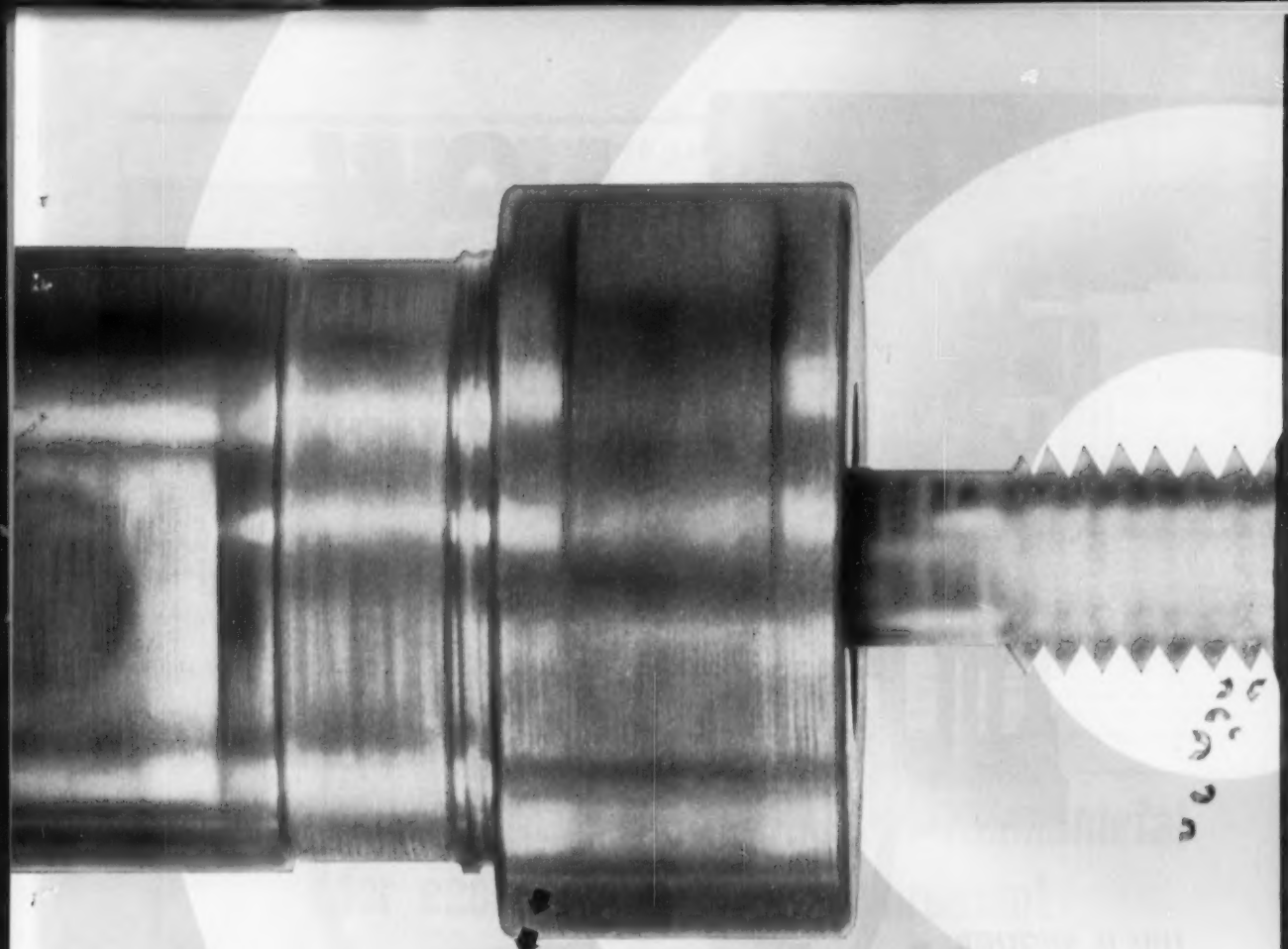


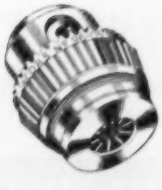
Tops for Taps...
it's a
Jacobs
CHUCK

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks... first in service.

THE JACOBS MANUFACTURING COMPANY • WEST HARTFORD, CONN.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Rubber-Flex® Tap Chuck for tapping heads and impact tools.

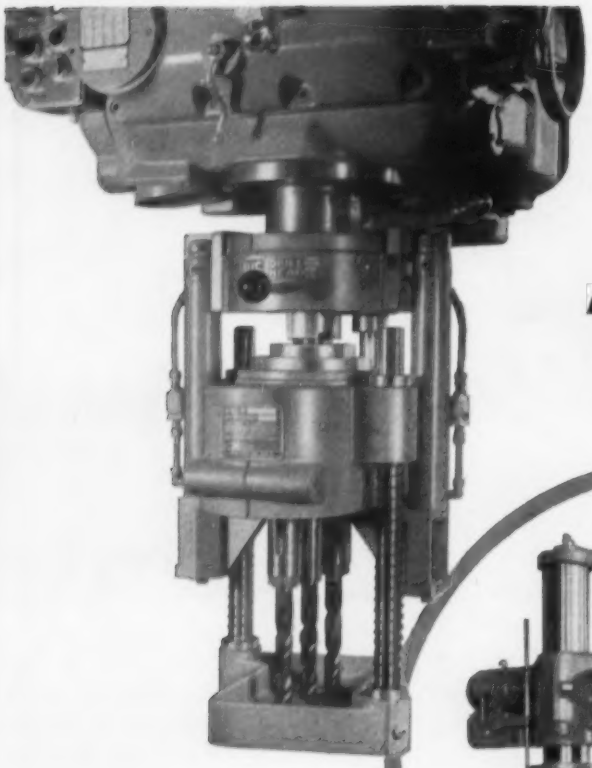


The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

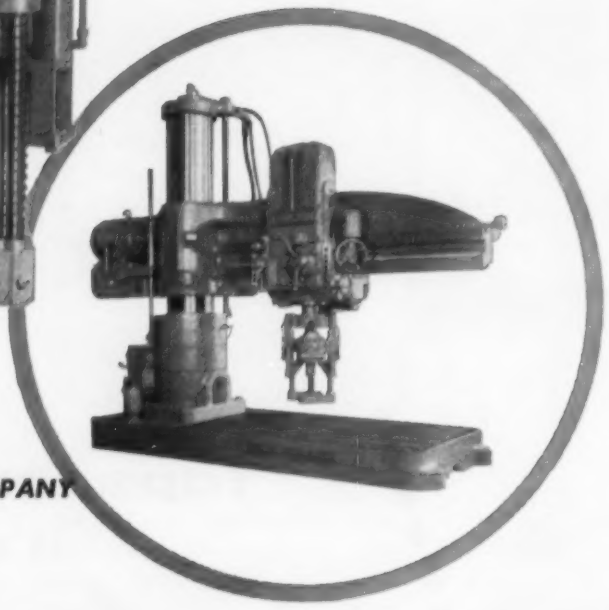
The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.



new

DRILL HEAD AIR COUNTERBALANCE SWIVEL ATTACHMENT

FOR RADIAL DRILLING MACHINES



THIS IS ANOTHER FIRST FOR THE U. S. DRILL HEAD COMPANY

This new combination Swivel and Air Counterbalance attachment makes it possible to adapt large multiple spindle drill and tapping heads to radial drilling machines.

Flexible and easily adjusted, it insures maximum safety for the operator, as well as better operating economy.

Two cylinders maintain a balanced condition of the head on the machine, with the air in the counterbalancing setup being controlled on both ends of the stroke. Therefore, only sufficient pressure is maintained to counterbalance the weight of the head during all portions of the stroke. On the return stroke, the air is controlled to prevent extreme, quick return of the head. Attachment includes air filter, pressure regulator, and an air oiler, and incorporates a 360° swivel feature fully aligning the drill head. It operates equally well with the fixed center type head and the adjustable type head.

This package is ideally suited for drilling condenser plates, boiler tube sheets, flue sheets, etc.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U. S. DRILL HEAD — FIVE TO ONE

Manufacturers of all types of Fixed Center, Adjustable, and Individual Lead Screw Tapping Heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

PROPERTIES OF KENNAMETAL DIE GRADES

Grade	Hardness (Rockwell A)	Transverse Rupture psi	Young's Modulus of Elasticity psi	Compressive Strength psi	Suggested Applications
K82 K84 K86	90.0 91.0 91.5	275,000 300,000 250,000	65,500,000 74,000,000 72,000,000	663,000 600,000 590,000	Draw dies (all sizes) for drawing tubes, bars and wire; for cupping and deep drawing.
K90	85.0	360,000	61,600,000	518,000	Heavy blanking dies up to 3/16" steel. Dies for: cold-heading, nail gripping, nibbling, swaging steel rods, heavy curling, coining.
K91	86.5	380,000	64,400,000	540,000	Light-heavy blanking up to 1/16" steel; rivet sets, crushing hammers, washers, dies.
K92	87.5	385,000	71,900,000	572,000	Lamination dies on .004" to .035" silicon steel; medium blanking dies softer metals up to .040"; heavy forming dies; heavy heading machine hammers; hardware curling dies.
K94	90.0	325,000	77,900,000	600,000	Tube swaging dies; light blanking up to .020" silicon steel; medium blanking, softer metals up to .040"; heavy forging dies; heavy heading machine hammers; curling dies for hardware.
K95	90.5	300,000	82,000,000	644,000	Light blanking up to .015" silicon steel; light heading hammers; wear-resistant parts.
K96	92.0	250,000	94,300,000	800,000	Dies for asphalt floor tile; slate-covered asbestos shingles; abrasive-covered roofing papers; and in the paper industry for slitter knives and plates; blanking and pressing dies; compacting dies for powder metallurgy, wear-resistant parts.

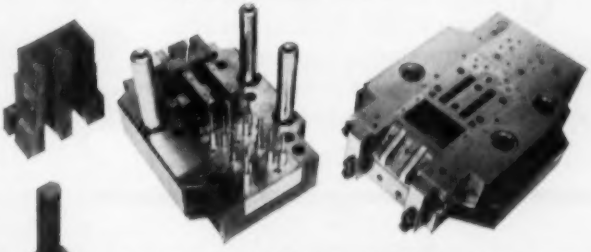
You can select the right grade of Kennametal* for each specific die requirement

With six grades in the "90 series" and three grades in the "80 series," Kennametal offers the right grade for any die application. The 90 series covers the full range of tungsten carbide grade requirements—from K90 with exceptional strength for heavy operations to K96 with maximum resistance to wear for such jobs as compacting and cutting highly abrasive materials.

In the 80 series, Kennametal offers three exclusive grades with unique properties not found in any other carbide. These three $WTiC_2$ grades, with a special slippery quality, have been created especially for drawing, forming and sizing operations where the slightest amount of galling or pickup cannot be tolerated.

From these two groups you can select the right grade for each specific job to assure highest production rates, to reduce die cost and maintenance, and provide products of uniformly accurate dimension and finish. Kennametal die engineers will gladly work with you in analyzing your die operations. They can show you performance reports on Kennametal over a wide range of applications—many of which may be similar to your operations. Call your nearest Kennametal office or write us direct. If you wish more information, send for Booklet B-100 and a copy of our new die grade selection chart. Kennametal Inc., Latrobe, Pa.

*Registered Trademark



Use Kennametal Die Grades for blanking, stamping, compacting, perforating, cold heading, swaging, forming, cupping, drawing. Illustrations show a few of the many types of die parts made of Kennametal for producing a diversification of shapes to exact tolerances with a minimum of finish grinding.

7200

MINING, METAL AND WOODWORKING TOOLS

WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND
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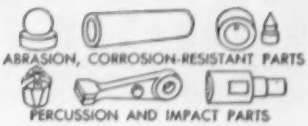
...Partners in Progress



ABRASION, CORROSION-RESISTANT PARTS

PERCUSSION AND IMPACT PARTS

Investigate the assembly savings made possible by P-K self-tapping screws

Because P-K Type A Self-tapping Screws have clean, deep slots and sharp gimlet points . . . and because they are consistently uniform, Reznor Mfg. Co. enjoys important savings in the assembly of their gas heaters.

To hold the plastic handle halves of their Instant Heat Soldering Irons together, The Lenk Mfg. Co. specifies P-K Type F Self-tapping Screws. No need for a separate tapping operation. Production is increased and costs reduced—thanks to P-K Screws.

Melnor Industries, Inc. (formerly Melnor Metal Products Co.) puts assembly strength into their famous "Swingin' Spray" oscillating lawn sprinkler by fastening zinc and aluminum parts with P-K Self-tapping Screws—7 Phillips Head Type Z and 18 Type F. They start right . . . drive right . . . and stay tight.

PARKER-KALON DIVISION, General American Transportation Corporation
Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws

PARKER-KALON® fasteners

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Let him take care of your file needs . . . help you with filing problems . . . simplify your file purchasing . . . save you money. *Your* problems become *his.*

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4. **Offers counsel of a Heller factory file engineer to survey your use of files and make recommendations that help your file dollars go farther.**

Heller is the originator of the famous VIXEN Milled Curved-Tooth file, the Wavy-Teeth NUCUT American Pattern file and the Spiral-Cut Half Round File. *The best source of supply is your Industrial Supply Distributor.* Call on him for ALL your file, hammer and tool needs.

HELLER TOOL CO. NEWCOMERSTOWN, OHIO
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America's oldest file manufacturer

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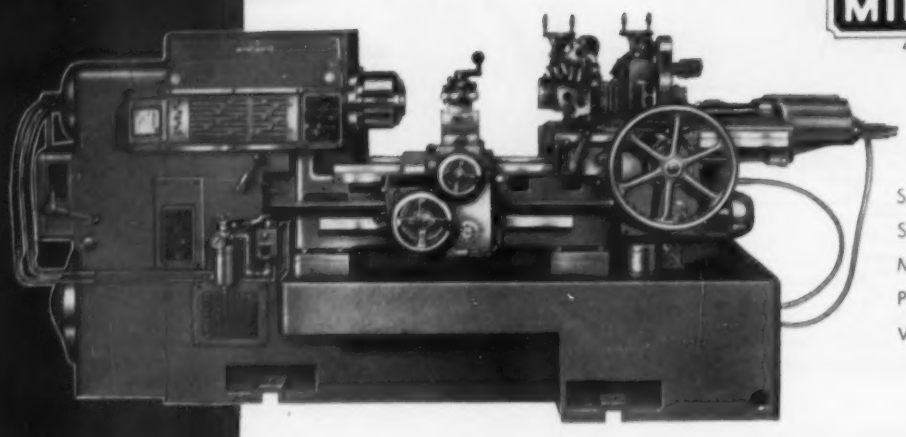
MINGANTI
BOLOGNA



Spindle bore	2 1/4"
Swing	18"
Max speed	rpm 3000
Power	HP 8
Weight	lbs. 6000

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HIGH SPEED BAND SAWS

FASTEST, BEST MEANS OF CUTTING METALS

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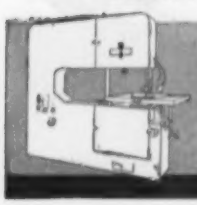

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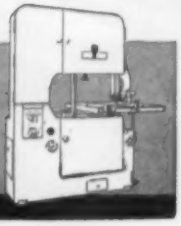
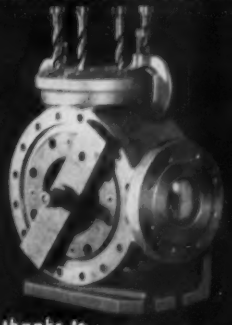
The smoothest, fastest, most trouble-free Bi-Saws on the market. Write for bulletin.



DRILLS 7% MORE GRAY IRON VALVE BODIES PER SHIFT



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Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged 89.5% greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE... because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

FOR FREE BOOKLET on FERROCARBO, citing actual case histories of faster machining, with longer tool life, write The Carborundum Company, Dept. 11, Niagara Falls, N.Y. 56-93

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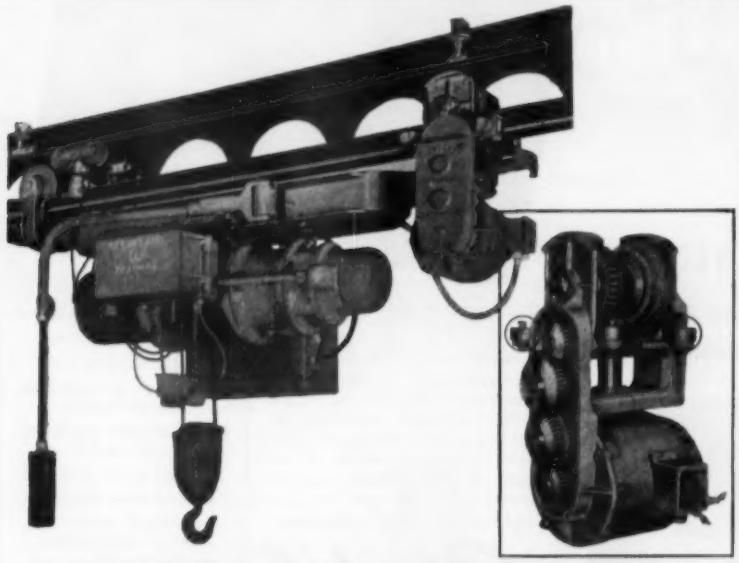
BEARING TIPS by McGill



CLEVELAND TRAMRAIL GUIDES MOTOR HEADS ON McGILL CAMROL BEARINGS

Motor-driven electric hoist carriers made by the Cleveland Tramrail Division of The Cleveland Crane & Engineering Company, incorporate McGill CAMROL Cam Follower bearings as side guide rollers for the motor head.

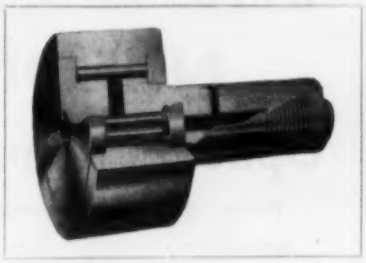
The CF bearings keep the motor head square on the monorail track used in this system and guide the head around curves. Moving on the rails at speeds up to 250 feet per minute, the bearings take the thrust load when entering into a curve.

Replacing spring loaded friction type bolt and roller units, the simplicity of mounting and the friction-free operation of the CAMROL cam followers provide dependable, trouble-free operation of the carrier assembly. Used almost six years, bearing performance has been most satisfactory.

Fact-packed Bearing Catalog

Write for your copy of Catalog No. 52, a revised 140-page Bearing Selection Guide. It contains vital product information and 30 pages of engineering data.

CAMROL BEARINGS DIRECT ACCURATE CAM ACTION



Precision built throughout, CAMROL CF Bearings are designed to add the advantages of smooth accurate cam action to rugged shock-absorbing dependability in any type cam follower application. An interchangeable sealed SCF series protects critical installations.

Lodge and Shipley Lathes Support 18' Propellors on Camrol CYR Bearings

Eighteen foot propeller shafts and other large work are supported and guided accurately on Lodge and Shipley Lathes through use of Camrol CYR Bearings. The Lodge and Shipley Company has standardized on these heavy duty Cam Yoke Roller Bearings for the Roller Jaw Steady Rest on their larger Engine Lathes. Four CYR bearings are mounted in a yoke at the ends of adjustable slides to provide dependable, precision support for a variety of work.

CAMROL CYR Series Adapts To Yoke Mounting

Internal construction of the CYR Series bearing is similar to that of a CF Series bearing with a heavy outer ring selection to withstand shock load. However, the stud is replaced by an inner ring for receiving shaft in a yoke mounting.

Insure performance with McGILL®

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Full Type Roller Bearings

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Cut Inspection Costs

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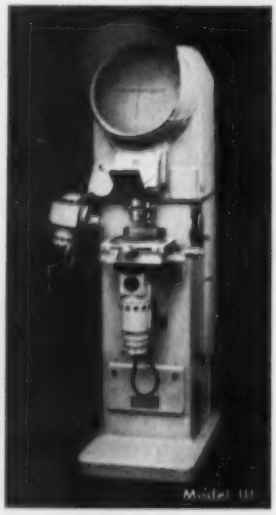
NIKON

Optical Comparator

Permits the study and measurement of surface textures as well as edge contours

A Nikon Optical Comparator permits critical examination of small objects, by projecting their magnified images onto a viewing screen. Because the magnifications are precise, the dimensions of the object can be readily derived from measurements taken of the projected image.

For example, a precise enlarged contour pattern on a translucent sheet, placed onto the viewing screen, can serve to define the tolerance limits of an object or part under inspection. Several critical points can be checked simultaneously. Errors in judgment are virtually eliminated. The most intricate contours, and minute parts, are easily gaged by this technique.



Surface Illumination

One of the important features of the Nikon Optical Comparator is the added facility for surface illumination. This permits the surface topography of any material to be closely examined—for texture, finish, corrosion, wear, etc.

Nikon Optical Comparators are equipped with lens turrets —which permit rapid interchange to selected magnifications—and with fixed adjustment positions for condensers, to provide maximum illumination efficiency at each magnification.

Bright, Even Illumination

Most impressive in the performance of the Nikon Optical Comparators are the extreme accuracy, the overall sharpness of the projected viewing image, and the even brightness of illumination. These are functions of optics, a field in which Nikon has already demonstrated outstanding achievements in the development of new optical glass techniques, photographic lenses, prism binoculars, ophthalmic and other scientific instruments.

Another attractive advantage of the Nikon Optical Comparators is their surprisingly low cost.

Nikon Bench Model Comparators are also available

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Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

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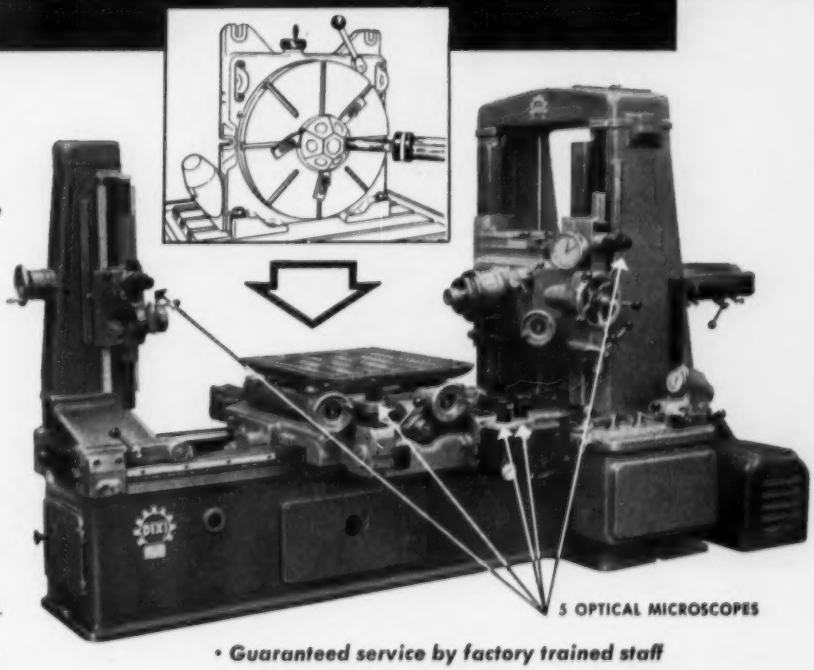
Overall accuracy of .0002"



A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

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Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.

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- ***Your operators trained***

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Names available upon request.

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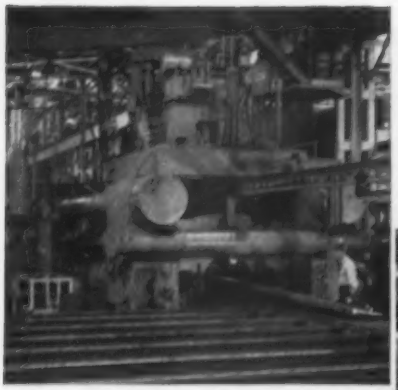
For the King and Queen of Extrusion Presses . . . it's FIRTH STERLING HOT WORK DIE STEEL



Giant press extruding an aluminum spar section.

2500 lb. die blanks and a finished extrusion die of Firth Sterling HWD Hot Work Die Steel.

At Kaiser Aluminum & Chemical Corporation's Halethorpe Extrusion Works, operated under a U. S. Air Force lease, are two 8,000 ton capacity extrusion presses—the largest operating units designed and built in the United States. Presently extruding large, complex aluminum shapes—wing spars, wing panel sections, and missile hull sections, for the aircraft industry, the two giant presses, named Rex and Regina, utilize dies made from Firth Sterling Hot Work Die Steel.

Yes, Firth Sterling HWD is a monarch in its own right, with properties capable of withstanding the tremendous pressures of this king and queen of extrusion presses. This intricate process requires materials that can operate continuously in volume production without replacement. These giant presses each weigh 1500 tons and are capable of extruding aluminum shapes more than 85 feet long and over 1200 pounds each in weight. The use of Firth Sterling HWD is tangible evidence of the high opinion modern die makers have of the quality of the material.

HWD Steel is just one of the Firth Sterling line of more than 50 Tool and Die Steels. Ask for a Firth Sterling engineer to cooperate in your next die making problem to assure the correct grade and analysis.

R-326

Firth Sterling

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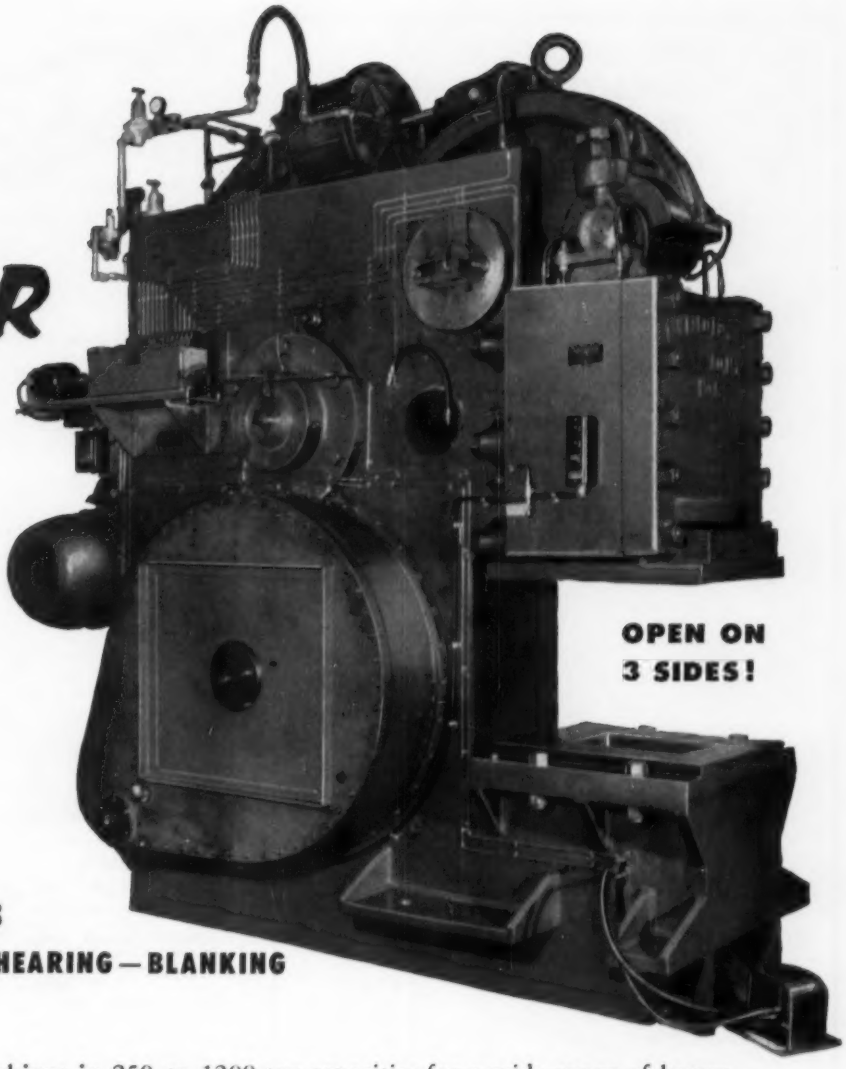

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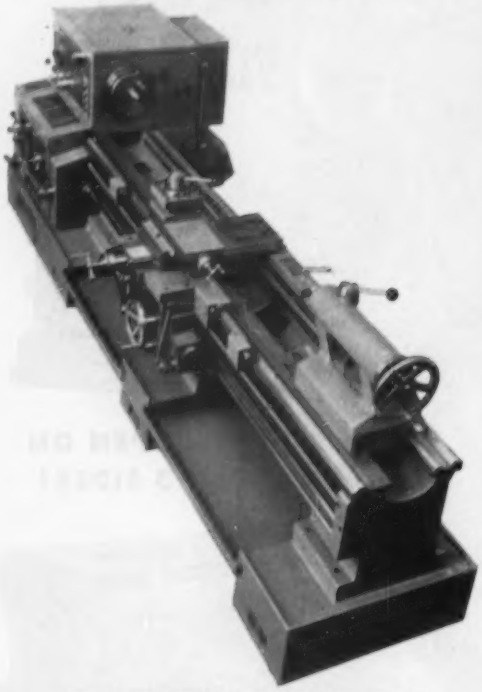
NEW MACHINES AS EXHIBITED AT THE NATIONAL METAL EXPOSITION CLEVELAND, OHIO



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HIGHEST PRECISION LATHES:

14″ swing x 30″ centers	2 HP		$ 2,750.00
14″ swing x 40″ centers	2 HP		$ 2,900.00
16″ swing x 30″ centers	3 HP		$ 3,000.00
16″ swing x 40″ centers	3 HP		$ 3,200.00
16″ swing x 60″ centers	3 HP		$ 3,400.00
16″ swing x 80″ centers	3 HP		$ 3,650.00
18″ swing x 80″ centers	5 HP		$ 5,000.00
24″ swing x 60″ centers	7½ HP		$ 6,900.00
26″ swing x 100″ centers	15 HP		$ 9,500.00
22″ swing x 120″ centers	15 HP		$ 9,900.00
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3. Being portable this efficient machine may be located in the department where cutters are being used, thus cutters may be sharpened and returned to service immediately. Systematic sharpening by the WALTHAM method minimizes the reduction of the cutter diameter. This eliminates costly adjustments necessary to re-establish the basic work dimensions.

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This low cost machine will handle internal keyseating jobs up to 1 in.

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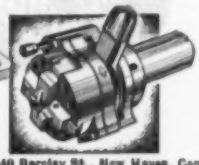
H&G Insert Chaser DIE HEADS



famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

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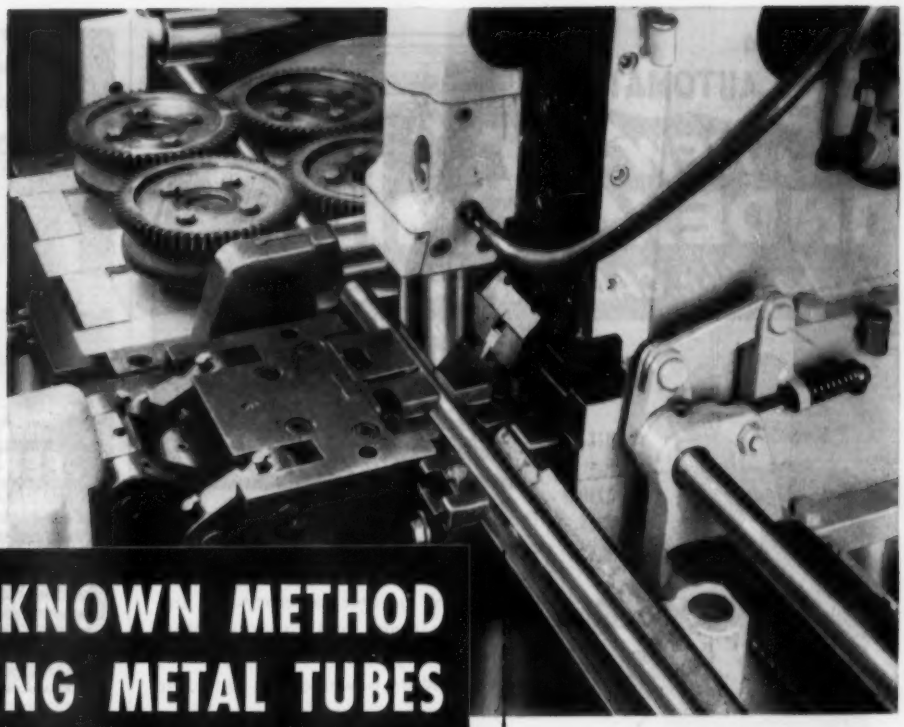

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Automatic continuous operation of up to 6,500 cut-offs per hour is approximately 3 to 8 times greater than the speed of competitive methods.

Cutting action in Grieder Tube Cut-off Machines is accomplished by two blades actuated by a crankshaft. A horizontal cut is made first, through the wall thickness of the top of the tube. The vertical blade descends into the opening and completes the cut. The tubing is held firmly in dies which operate as a vise preventing any distortion. Lengths can be held to plus or minus .002″ on light wall tubing and to approximately .003″ on heavier wall tubing.

Automatic hoppers for feeding tubes and related automation equipment are available in conjunction with Grieder Tube Cut-off Machines for specific applications. Tell us what you want to accomplish.

Grieder Tube Cut-off Machines are slicing tubes and slashing costs in most major industries. Write for literature.

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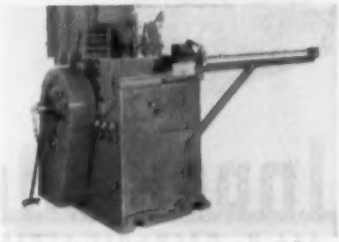
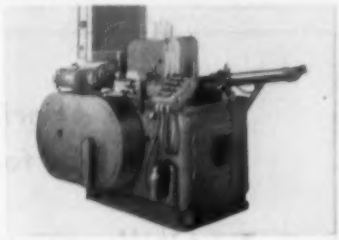
THREE STANDARD MODELS



NO. 1000-MAC cuts tubes up to ¾″ OD and up to .062″ wall thickness.



NO. 2000-MAC cuts tubes up to 2″ OD and up to .125″ thickness wall.

NO. 4000-MAC cuts tubes up to 4″ OD and up to .250″ wall thickness.

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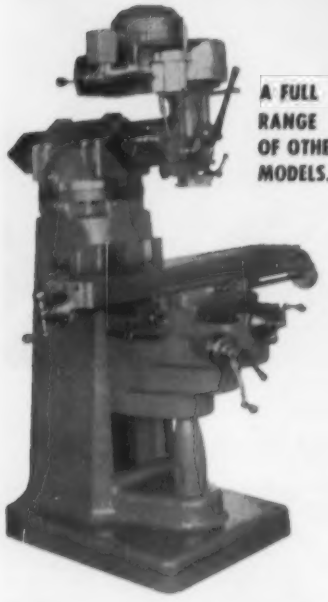
this NEW "45" INDEX MILL

has the "CALIBER" and "ACCURACY" to do your MILLING, DRILLING and BORING JOBS .. BETTER, FASTER AND MORE ECONOMICALLY!



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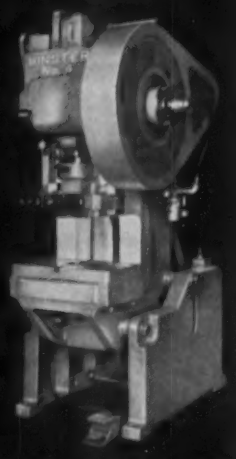

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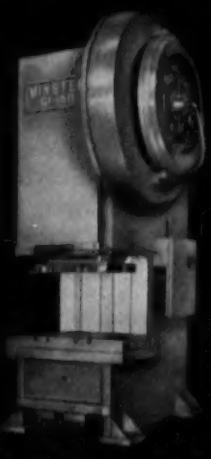

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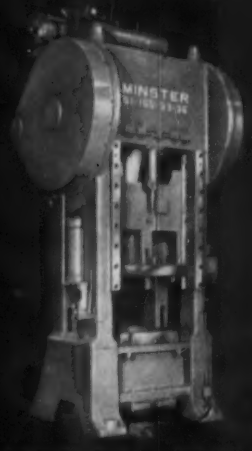

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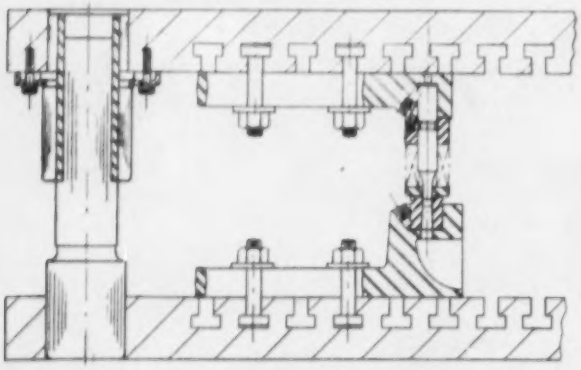

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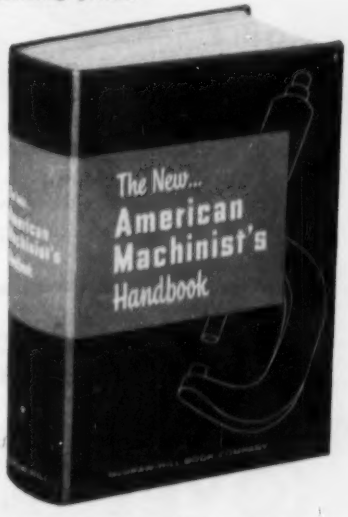

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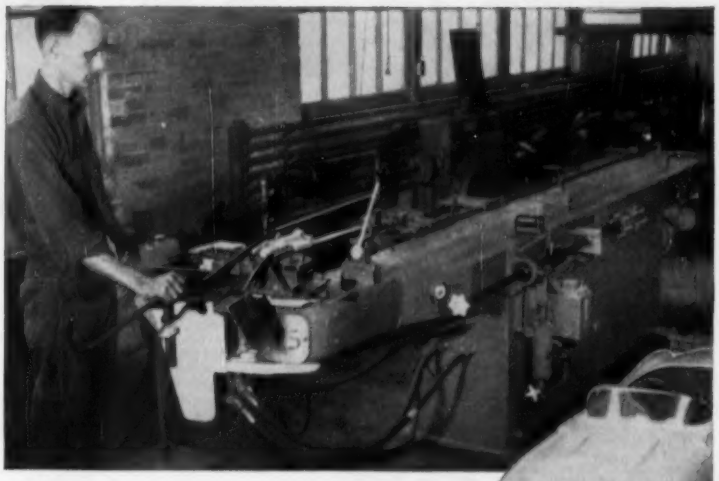

Over-all view of Pines Size ¾ Bender at Flexsteel Spring Division used for outside job work as well as for their own manufacturing needs. Application illustrates setup for bending long side members for toy Corvette car.

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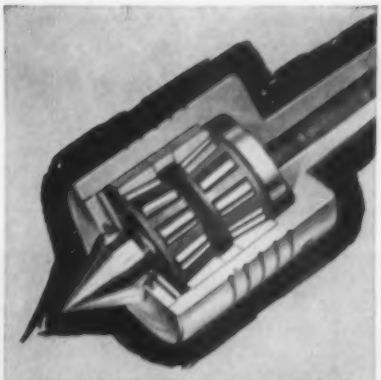

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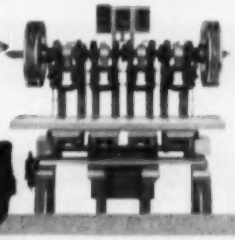

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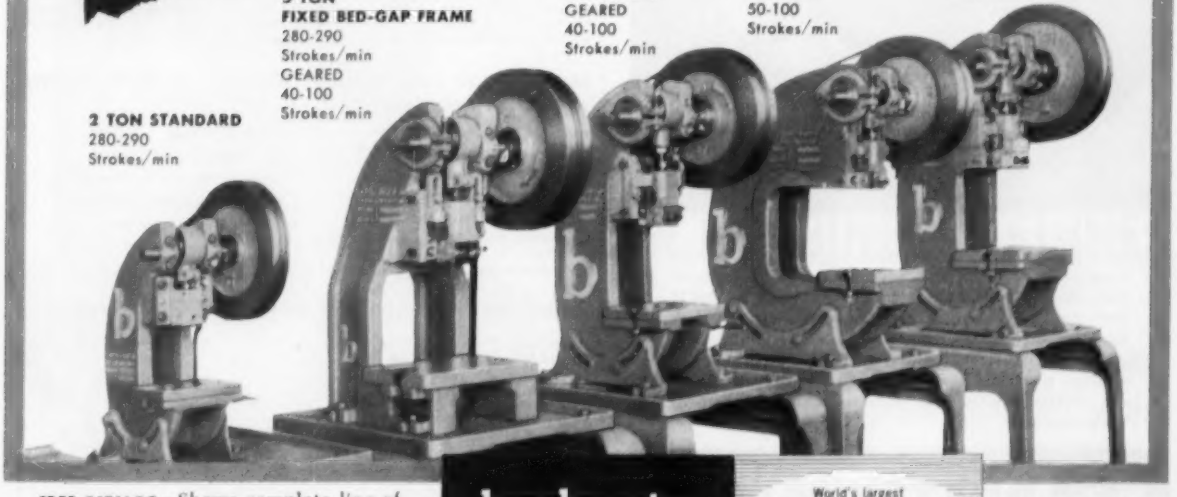

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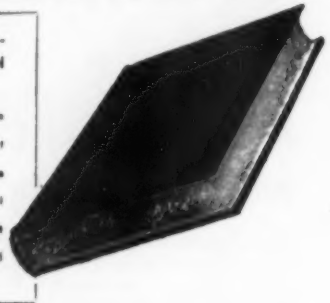

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- Designing Products to Reduce Polishing Expense
- Recent Developments in Plating
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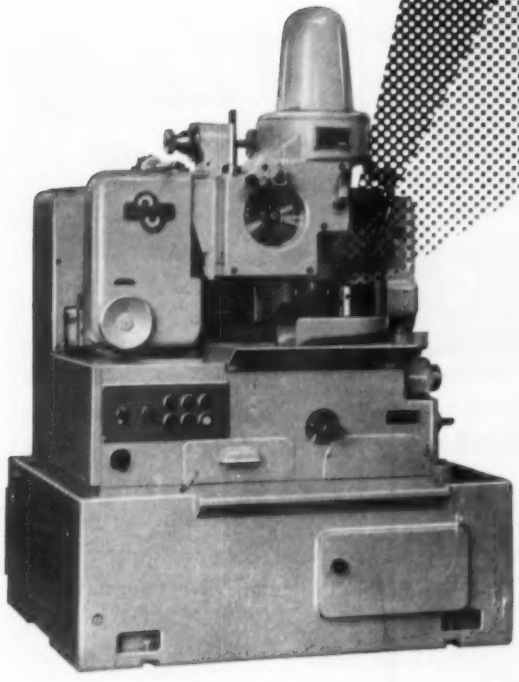

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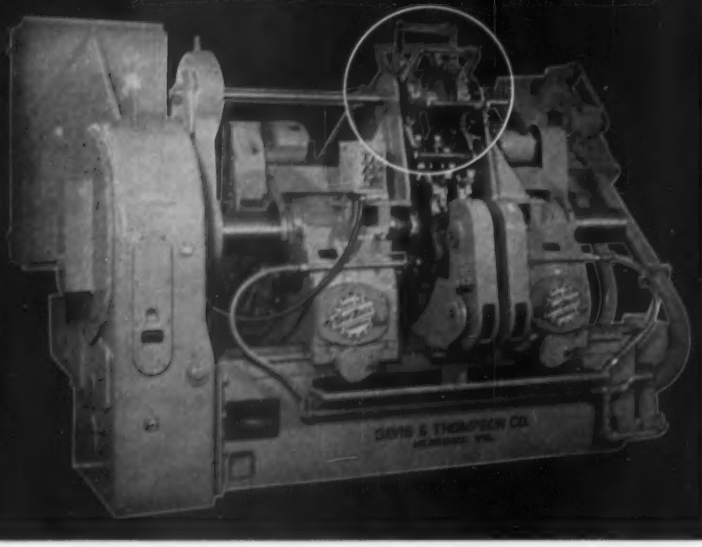

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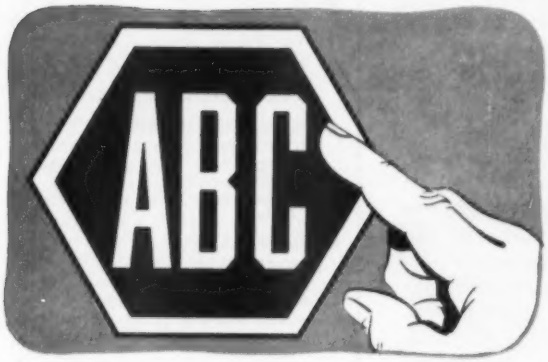

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Gaging . . .

the Surplus Machinery Market

The tight money market is starting to make itself felt in the used machinery business. Dealer after dealer, from coast to coast, reports potential customers are either deferring purchase of machine tools and production machinery—or else they ask for extended payments and long-term credit.

And it's not just the little buyers who are affected by the lack of expansion money. As one dealer puts it, "the blue chip outfits, who could be expected to have the needed cash right in their hip pockets, are finding the going a bit rough, too."

And it seems that tight money is affecting the customer's customer, too. Some potential buyers of used machinery are holding off on their expansion programs because their customers have cut the size of their orders. Typical is the case of a Midwestern dealer who had a customer all set to sign on the dotted line for a sizeable machine when the deal was called off because orders for the parts the machine was to make were slashed drastically without warning.

That's one reason why dealer "how's business?" reports vary widely today across the country. Business is picking up fast in the East, traditionally the bellwether for used machinery business in the rest of the country.

And out on the West Coast, where they've had a good summer, activity is today at a "normal steady high," is expected to stay that way through the balance of the year, except for the usual small December setback when customers prefer not to increase their inventories. November is expected to be particularly good, because that's the time when shops need equipment to finish up the year's contracts.

Dealers in Midwestern metalworking centers vary greatly in their estimates of the current business situation and outlook. Several say that business has risen little if any from levels that prevailed during the summer. Some of them view the next few months with uncertainty, but others are optimistic about the fourth quarter. The tight money pinch seems to be making itself felt more in the Midwest than elsewhere.

Will the new, higher prices of new machine tools increase demand for used machines? Many think that they will, particularly with expansion money hard to get. But on the other hand, used machinery prices are definitely up, too. It's all part of a price-rise spiral that comes about this way: the shop owner has to pay more for a new machine, therefore, knowing that used machines are in demand, he holds out for the top price he can get. The used machinery dealer, who has to pay more for a machine, naturally has to charge more when he resells it, and the wheel comes full circle back to the customer.

And while many dealers have tried to hold prices steady in the face of spiralling prices, most of them expect to feel the pressure of new machinery boosts in the next six months at the very latest.

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FELLOWS 8M Red Liner Checker
FELLOWS 12" Helical & Spur Shaver
GLEASON 12" Straight Bevel Generator
BARBER COLEMAN Type 5 Hobber
FELLOWS 64A Int. & Ext. Spur—1943

GRINDERS, CYLINDRICAL
NORTON Type C 6 x 30 Hydraulic Plain
NORTON Type C 10 x 36 Hydraulic Semi-Automatic
NORTON Type C 14 x 36 Hydraulic Plain

GRINDERS, SURFACE
THOMPSON 12" x 16" x 60" Hydr.
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COVEL #20 6 x 18 Hor. Hydr.

LATHES, ENGINE
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B & S #1 ⅝" Wire Feed Hand Screw
GISHOLT #4—2" Bar & Chuck
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GISHOLT #5—2½" Bar
GISHOLT #3—4½" Bar Ideal for tubing

MILLERS
B & S 2B Hi-Speed Plain
B & S 3B Hi-Speed Plain
K & T 2H Plain
K & T 5H Plain
K & T 2HL Swivel Hd. Vert.
VAN NORMAN #12 Tool Room
VAN NORMAN #22L Plain
VAN NORMAN #22LU Univ.

MILLERS, PRODUCTION
CINN. #2-16 R&F Cam Roller
CINN. #4-36 Hydromatic, 2-way cycle
K & T 16-54 Simplex

MISCELLANEOUS
GRAY 36" x 36" x 12' Double Housing Planer—1942
INGERSOLL 42" x 42" x 14' Double Housing, Adj. Rail Planer Type Milling Machine, 4 Heads, 1940
LaPOINTE HP 5 2½ Ton Hor. Hydr. Broach, 1947

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DEFIANCE Model 25A, 3¾" Bar Table Type; late
DETRICK & HARVEY No. 0, 4" Bar Floor Type.
DETRICK & HARVEY No. 1, 4" Bar Floor Type
GIDDINGS & LEWIS #340T, 4" Bar Table Type; Auto. positioning for Head & Table; New 1955
HEALD #48-A Single End, Single Spindle "Bore-Matic"; Late type
HEALD #49 Double End, 4-spindle "Bore-Matic"
HEALD #49 Single End Univ. "Bore-Matic"; late
LANDIS #35 Floor Type 3½" Bar motor drive
LUCAS #42 4" Bar "Precision" Table Type late type
LUCAS #41 Special Boring Machine; late type
NILES BEMENT POND 3½" Bar, Portable, floor
SELLERS 5" Horizontal Boring Mill, Floor Type; late

BORING MILL VERTICAL

BETTS 96", 2 Swivel Heads, Adj. Rail, M.D.
BULLARD 8" 6 Spindle Type D "Multaumatic" late
BULLARD 16" 6-Spindle Type D "Multaumatic" late
BULLARD 24" Vertical Turret Lathe; late type
BULLARD 36" Vertical Turret Lathe; Spiral Drive, with standard or extra high column; late type
CINCINNATI 42" 2 Swivel Heads(adj. rail; M.D. late type
KING 36" Heavy Duty; motor drive

GEAR EQUIPMENT—FELLOWS

FELLOWS #13-LS Gear Lapping Machine; late type
FELLOWS Type 6Z2 Gear Shaper High Speed cap. 35" O.D. 3" D.P.
FELLOWS No. 61A Gear Shaper; late type
FELLOWS No. 612 Gear Shaper; late type
FELLOWS No. 7 High Speed Gear Shaper; cap. 7" O.D. 5/16" D.P. New 1951
FELLOWS No. 7A High Speed Gear Shaper; late type
FELLOWS No. 75 High Speed Gear Shaper; late type
FELLOWS No. 77 High Speed Gear Shaper; late type
FELLOWS No. 715 High Speed Gear Shaper; late type
FELLOWS No. 4T Thread Generator cap., 4"x17" centers; late type
FELLOWS #24M Involute Measuring Instrument; late type

GEAR EQUIPMENT—GLEASON

GLEASON #1 Surface Hardener; late type
GLEASON 3" Straight Bevel Gear Generator; late
GLEASON 3" Spiral Bevel Gear Generator; late type
GLEASON #6 Straight Bevel "Revacycle" .450 D.P.; late type
GLEASON #7 Hypoid Cutter Sharpener late type
GLEASON 11 Straight Bevel Gear Generator; M.D.
GLEASON #12 Tool Sharpener; late type
GLEASON 12" Spiral Bevel Cutter Sharpener; M.D.
GLEASON #12 Straight Bevel Gear Roughor; late
GLEASON 12" Straight Bevel Gear Generator; late
GLEASON #14 Hypoid & Spiral Bevel Gear Grinder; late type
GLEASON #16 Hypoid & Spiral Bevel Gear Generator; late type 2½ D.P.
GLEASON 120 Straight Bevel "Coniflex Type" Gear Generator late type
GLEASON 15" Spiral Cutter Grinder; M.D.
GLEASON 15" Spiral Bevel Gear Generator; M.D.
GLEASON #15 Quenching Press Late type
GLEASON 18" Straight Bevel Gear Generator; M.D.
GLEASON 18" Bevel Gear Testing Machine; M.D.
GLEASON 25" Spiral Bevel Gear Generator; M.D.
GLEASON 24" Straight Bevel Gear Planer; M.D.
GLEASON 25" Straight Bevel Gear Generator; late
GLEASON 37" Spur & Straight Bevel Gear Planer;
GLEASON 54" Spur & Straight Bevel Gear Planer;

GEAR EQUIPMENT MISCELLANEOUS

SHEFFIELD (Cimatool) #201A Auto. Burring Machine; late type
MICHIGAN Model 862-24A Gear Finishing Machine —late type
BROWN & SHARPE #14 Straight & Bevel Auto. Gear Cutter; 54" cap. late type
CINCINNATI #4 Auto. Gear Cutter; cap. 36"; 2½ D.P.; late type
CINCINNATI #6A Auto Gear Cutter; cap. 72"; 1½ D.P.; late type
CINCINNATI #7A Auto Gear Cutter; cap. 84"; 1½ D.P.; late type
ROBEY SMITH #1 Straight Bevel Gear Planing Machine M.D.
GOULD & EBERHARDT #36BM; 3-Spindle Gear Rougher 2 D.P.; M.D.
GOULD & EBERHARDT #36BT Gear Rougher 4 D.P.; M.D.
MICHIGAN Model 854 Rack Type Gear Shaver; M.D.
DETROIT Type GG-35 Gear Grinder; late type
PRATT & WHITNEY 16" Gear Grinder; single wheel; type; cap. 10-11/16"
PRATT & WHITNEY 26" Universal Hyd. Gear Grinder; single wheel; pitch range 2 to 12; late
BILGRAM 6" Bevel Gear Generator; M.D.
BILGRAM 16" Bevel Gear Generator; M.D.
BROWN & SHARPE #1 Spur Gear Testing Machine; late type
BROWN & SHARPE #13 Straight & Bevel Auto. Gear Cutter 16" cap., 4 D.P., M.D.
CROSS #1 Gear Tooth Rounding Machine; cap. 4 pitch or finer to 24" dia.; 2 pitch or finer to 6" dia.
CROSS #40 Gear Tooth Pointing & Chamfering Machine; gear face 10", gear dia. 20"
CROSS #45 Gear Chamfering Machine; late type

GRINDERS MISCELLANEOUS

BARBER COLMAN 4-4 HOB Auto. Sharpening Machine; New 1954
CINCINNATI #2 Universal Tool & Cutter Grinder; late type
CINCINNATI "MONOSET" Tool & Cutter Grinder —Model 0; late type
EAGER #413 Double End Pedestal Grinder; late type
EXCELLO #46 Carbide Tool Grinder; late type
GALLMEYER & LIVINGSTON Model A-7-Y Drill Grinder; late type
GARDNER 24-53" Plain Type Disc Grinder; M.D.
GARNDER #120A Double End Disc. Grinder; cap. Wheel dia. 20"; late type
HEALD #1 Tool Sharpening Machine; late type
HISEY-WOLF Type 3 Model #1 Slot Grinder; late type
INGERSOLL 30" Cutter Grinder; late type
LANDIS 25"x72" Crankpin Grinder; late type
PRATT & WHITNEY Contour Cutter Grinder; late type
ROTOREX #1 Universal Tool & Cutter Grinder; late type
SELLERS Model 6G Drill Grinder; late type
SELLERS #4T Tool Grinder; late type
K. O. LEE model B-600 Tool & Cutter Grinder; late type

ROCKFORD 36" Openside Hy-Draulic Shaper; 2 heads; New 1953

LATHES ENGINE

BRIDGEFORD 42"x50' Centers Geared Head M.D.
DENHAM 18/36"x48" Centers Geared Head, Gap Type
HENDEY 14"x102" Centers "Precision" Toolroom Lathe; late type
HENDEY 14"x30" Centers Yoke Head; M.D.
HENDEY 12"x30" Centers "Precision" Toolroom Lathe; late type
HENDEY 12"x54" Centers Yoke Head; M.D.
HENDEY 16/24"x30" Centers Toolroom Lathe Raised in Sand to Swing 26"; late type
HENDEY 16"x78" Centers Yoke Head; M.D.
HENDEY 18"x48" Centers Geared Head; M.D.
LEBLOND 16"x102" Centers Heavy Duty; late type
LEBLOND 18"x78" Centers Heavy Duty; late type
LEBLOND 20"x48" Centers Heavy Duty; late type
LEBLOND 27" x 144" Centers Geared Head; M.D.
LODGE & SHIPLEY 12"x30" Centers Toolroom; late
LODGE & SHIPLEY 14"x30" Centers; late type
LODGE & SHIPLEY 16x30" Centers Cone Head;
LODGE & SHIPLEY 18"x54" Centers Model X; late type
LODGE & SHIPLEY 22"x60" Centers Model X; late type
LODGE & SHIPLEY 24"x54" Centers Heavy Duty; Swing over Bed 29"; late type
MONARCH 12"x54" Centers Model CKK Precision; late type
MONARCH 18"/26"x72" Centers Model CBB raised in sand to swing 26½"; late type
MONARCH 18"x72" Centers, Model CBB; late type
MONARCH 18"x72" Centers Model CBB WITH KELLER COPYING ATTACHMENT; late type
MONARCH 22"x264" Centers Model M 2 carriages; late type
MONARCH 22"x336" Centers Model M 2 carriages; late type
MONARCH 36"x84" Centers Model "NN" heavy duty; late type
NEW HAVEN 42"x120" Geared Head M.D.
NILES BEMENT POND 120"x96" Centers Heavy Duty; 2 carriages; M.D.
PRATT & WHITNEY 16"x30" Centers Toolroom Model C; late type
SOUTH BEND 9"x4' Engine Lathe, Model 644A; late type
SPRINGFIELD 14"x43" Centers Geared Head; M.D.
NILES BEMENT POND 36"x100" Centers
WOLCOTT 28"x14' Cone head back geared
WOLCOTT 26"x10' Cone head back geared
ROCKFORD 18"x8' Cone head back geared
LEBLOND 19"x8' Cone head, back geared

LATHES MANUFACTURING

BLOUNT 12"x8' Centers Polishing Lathe; late type
BLOUNT 20"x60" Centers Polishing lathe—Model B3; late type
BLOUNT Model B-2 12"x48" Centers Pedestal Mounted Polishing Lathe; late type
GISHOLT #12 Hydraulic Automatic 12" swing; late
H.E.B. 17"x40" Centers High Speed Hyd. Copying Lathe; late type
JONES & LAMSON "FAY" 20"x25" Centers Auto.
LEBLOND Model 7AC Crankshaft Turning; late type
LEBLOND 16"; 16"x36" Centers Automatic Turning
LEBLOND 25"x54" Centers Heavy Duty Rapid Prod.
LEBLOND 42"x26' Bed Single End Boring Lathe
LIPE "CARBO" 12"x18" Centers Production Lathe; late type
LODGE & SHIPLEY #5 x 24" Centers Duomatic Auto; late type
LODGE & SHIPLEY #5 x 96" Centers Duomatic Auto; late type
LO SWING (SENECA FALLS) 4"x60" Automatic
LO SKING (SENECA FALLS) 4"x84" Automatic
LO SWING (SENECA FALLS) 8"x108" Automatic
MONARCH 14"x42" Centers Model Z Single End Mag. Auto; late type
NILES 30"x25' Bed Boring Lathe; late type
PRATT & WHITNEY 7"x16" Centers Bench Lathe
SUNDSTRAND Model 12"x22" Automatic Chucking; late type
NILES 30"x50' Bed Single End Boring Lathe; late
L & G 33"x10' Double End Crankshaft Polisher; late type

LATHES TURRET

GISHOLT #1L Univ. Saddle Type; Swing 10"; late
GISHOLT #2L Saddle Type Swing 22⅝"; late type
GISHOLT #3 Univ. Ram Type; Swing 18½"; late
GISHOLT #5 Univ. Ram Type Prece'ector Head; Swing 19½"; late type
JONES & LAMSON #3 Univ. Ram Type; Swing 21¼"; late type
LIBBY (INTERNATIONAL) Model 4-12 Saddle Type; Swing 32"; late type
MOREY #2 Ram Type; Swing 14"; late type
MOREY #3 Univ. Ram Type Swing 18½"; late type
MOREY #4 Univ. Ram Type; Swing 18½"; late type
WARNER & SWASEY #1 "ELECTRIC"; Swing 11"
WARNER & SWASEY #1A Univ. Saddle Type; Swing 18"; late type
WARNER & SWASEY 2A Univ. Saddle Type; Swing 21¼"; late type
WARNER & SWASEY 3A Univ. Saddle Type; Swing 24½"; late type
WARNER & SWASEY #4 Univ. Ram Type Pre-selector Head; Swing 18½; hole 2-7/16"; for Bar or Chucking; late type

SCREW MACHINES, AUTO. BAR OR CHUCKING

ACME GRIDLEY Model RB 6 Spindle 2" High Speed New 1951
BROWN & SHARPE No. 00G — Auto. Cap. ⅝" Round; late type
CLEVELAND 3⅛" Model A Single Spindle Automatic; late type
CLEVELAND 7⅛" Model A Single Spindle; Automatic; late type
CONOMATIC 1⅝" 8-Spindle Automatic; late type
CONOMATIC 4⅛" 4-Spindle Automatic; late type
NEW BRITAIN GRIDLEY Model 6S—6 Spindle Automatic Chucking; Swing late type
GREENLEE 1⅝" Six-Spindle Automatic; late type
GYROMATIC "TAVANNES" #40 6-Spindle Auto; late type
CONOMATIC 1⅝" 6-Spindle Automatic; late type
CONOMATIC 1⅝" 8-Spindle Automatic; late type
CLEVELAND 1⅛" Model A; 4-Spindle Automatic; late type
CLEVELAND 2½" Model A, Single Spindle Automatic; late type
GREENLEE 1⅝" 6-Spindle Automatic; late type

PLANERS

SOUTHWARK #1 Horizontal Plate Edge; cap. 1½ x 16 ft. M.D.
DETRICK & HARVEY 48"x48"x16' Double housing; Hyd; 4 heads, M.D.
GRAY 48"x48"x10' Double Housing; 4 heads; D.C.
LIBERTY 144"x76"x48' Convertible openside; 4 heads; vari-voltage
NILES 48"x48"x10' Double Housing; 4 heads; D.C.
NILES BEMENT POND 60"x60"x14'; Double Housing; 4 heads; D.C.; M.D.
NILES BEMENT POND 72"x72"x30' Double Housing; 4 heads; vari-voltage; M.D.
SELLERS 48"x48"x14' Double Housing "Power-Flo"; 4 heads; D.C., M.D.
NILES BEMENT POND Horizontal, 36"x36"x14' Double Housing; 4 heads, M.D.

MILLERS, PROFILERS AND DUPLICATING MACHINES

CINCINNATI Vertical Hydrotel 28"/60" High Power Auto. Depth Control size of table 28"x143" Longitudinal feed—120" late type
MOREY 12M, 2 Spindle Vertical Profiler & Milling Machine—working surface of table 12"x15"
PRATT & WHITNEY GG "Keller" Auto. Toolroom Machine—working surface of table 18"x19" horiz. travel of column 12"; Vertical travel head 10"
PRATT & WHITNEY Model BL-2416 "Keller" Auto. Tracer Control Milling Machine for 2-dimensional Tracing—working surface of table 23"x42"
PRATT & WHITNEY Model BL-2416 "Keller" Auto. Tracer Control Milling Machine for 3-dimensional Tracing—working surface of table 22"x42"

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No. 1B Milwaukee, m.d.
No. 2 Cincinnati Plain H.S. Dial Type, m.d.
No. 2B Brown & Sharpe, m.d.
No. 3B Brown & Sharpe, m.d.
No. 3E Milwaukee, m.d.
No. 4B Brown & Sharpe Plain, m.d.
No. 3 Cincinnati Plain H.P., Dial Type, m.d.
No. 5 Cincinnati Plain H.P., m.d., late
No. 22L Van Norman Ram Type Swivel Head, m.d.
No. 2LP Van Norman, m.d.

THREAD MILLING MACHINES

12x24" centers Lees Bradner Model HT, Heavy Duty, m.d.
12x36" Lees-Bradner Universal Type, m.d.
12x54" Lees-Bradner Universal Type, m.d.
12x102" Lees-Bradner Universal Type, m.d.
14"x16" U6 Automatic Hob, m.d.
No. 40 Lees-Bradner Automatic Universal, m.d., late
Hall Planetary, m.d.
Model B Hall Planetary, m.d.
Model C Hall Planetary, m.d.
Murchey Planetary, m.d.

VERTICAL MILLING MACHINES

No. 1-14 Kent Owens, m.d.
No. 6B Cincinnati, m.d., latest
54" Ingersoll Single Spindle Adjustable Rotary Mill, m.d.
54" Ingersoll two spindle Rotary Mill, m.d.
No. 4 Cincinnati Vertical High Power, m.d.
No. 2K Kearney & Trecker "Milwaukee", m.d.

MANUFACTURING TYPE MILLING MACHINES

No. MM-1-6 U.S. Multi-Miller, m.d.
24" Cincinnati Plain Automatic, m.d.
24" Cincinnati Duplex Automatic, m.d.
No. 21 Brown & Sharpe Automatic, m.d.
48"x16" Newton Slab Miller, m.d.
48" Cincinnati Auto. Duplex Production Mill, m.d.
54"x36"x16" Ingersoll Slab Miller, m.d.
No. 1-18 Cincinnati Plain Automatic
M80 Taylor & Fenn Duplex Spline Miller, m.d., latest type
Model 1402 Kearney & Trecker Simplex, m.d.
No. 33 Simplex Production Miller, m.d.

PROFILERS

No. 12B Pratt & Whitney Model 1693, 2 spindle, 1944
No. 12M Morey 2 spindle, m.d.
4 spindle 360° Cincinnati Automatic, m.d., 1944

SLOTTERS

10" Newton, m.d.
18" Betts, m.d.
18" Niles-Bement, s.p.d.
20-24" Pattern Dill, m.d.
22" Betts, m.d.
48" Niles, m.d.

PLANERS

P10 Coulter Crank Type Shaper-Planer, m.d., 1 head
30"x30"x10' Cincinnati, belted m.d., 2 heads
30" widened to 36"x30"x8' Gray, belt drive
36"x36"x8' Cincinnati, m.d., 2 heads on rail
36"x36"x12' Betts, m.d., 2 heads
36"x36"x12' G. A. Gray, 3 heads
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' G. A. Gray Extra Heavy, belt, 2 heads on rail
36" widened to 42"x36"x20' Cincinnati, m.d., 2 rail heads, 1 side head
36"x36"x30' Cincinnati, m.d., 4 heads
42"x24"x16' Cincinnati Hypro Extra Heavy Frog & Switch
42"x42"x28' G. A. Gray, 2 heads, belted motor drive
48"x48"x12' Cincinnati, 4 heads
48"x48"x18' Niles-Bement-Pond, 2 heads, belt
48"x48"x18' Detrick & Harvey, 4 heads, reversing m.d.
48"x48"x28' Cincinnati, reversing m.d., 4 heads
56"x42"x14' Cincinnati, belted m.d., 2 heads
72"x72"x20' table Niles Double Housing, m.d.

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52" Betts Car Wheel Borer
90" Niles Balanced Quartering & Crank Pin Turning Machine, latest
60" Niles Journal Turning Locomotive Lathe, including 2 inside Journal Turrets and 3½" spindle double quartering Attach., m.d.
50" Niles Driving Wheel Lathe, m.d., latest
No. 3 Betts Bridgeford Axle Lathe, m.d.

SHAPERS

No. 14 Cochran Bly Vertical Shaper, m.d.
6" Pratt & Whitney M1506, Model B Vertical Shaper
16" Smith & Mills Universal, m.d.
24" Hendey Back Geared Crank Shaper, m.d.
24" Potter & Johnston, cone
32" Morton Draw-Cut, m.d., late
32" Ohio Shaper, m.d.
32" Cincinnati, m.d., late
32" Columbia H.D. Plain Back Geared Crank Shaper, m.d.
36" Morton Draw-Cut, m.d., late
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38" Morton Draw-Cut Shaper

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No. 5 Gisholt ram type universal turret lathe, new 1940. Arr. bar & chucking.
Models BL2416-BL3616 F & W Keller machines (3) one late
14" x 42" cc Hendey toolroom engine lathe, new 1940.
No. 5-48 Cincinnati hydromatic duplex mill, late
No. 4 Cincinnati high-power plain horizontal mill, serial E506J.
No. 4 Gallmeyer & Livingstone universal tool & cutter grinder, new 1941.
5' arm 13" col. Fosdick "Economax" hydraulic radial drill, new 1943.

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20"x54" cen. Reed Prentice '43
TURRETS No. 2H10 Libby 10¼", '43
Nos. 5 & 3 B. & O. '43
No. 3 Gisholt, Bar Chuck, '42
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SHAPER, VERT., 12" Pratt & Whitney, 1942
SLOTTER, 36" Rockford, Hyd., '44

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6 Spindle No. 2 LMS Leland-Gifford Drill Press. Late Type.

No. 2 M. T. Six Spindle ALLEN Type KH Drill Press. Individual Motor Drive. Late Type.

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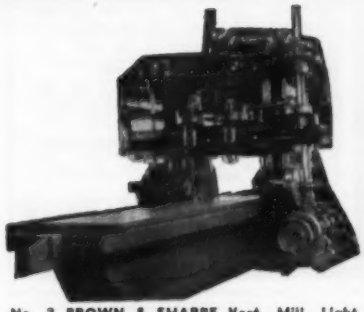
1A PRATT & WHITNEY Jig Borer, with Gauges, Rods, Collets and Chuck.



No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late.

42" by 36" x 12" INGERSOLL Planer Type Mill, two heads on rail, two side heads, M.D.

No. 28-60 CINCINNATI Vertical Hydro-Tel Mill 2 Spindle and Tracer Spindle.

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4T SELLERS Tool Grinder, M.D. Late Type.

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MISCELLANEOUS

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12" ROCKFORD Hydraulic Vertical Shaper. 1953.

14" Jones & Lamson Comparator, Late Type.

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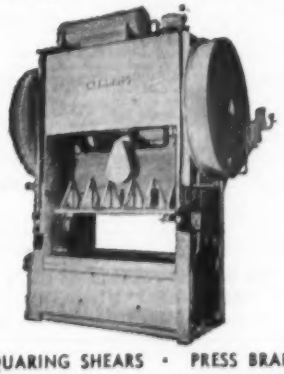

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PARTIAL LISTING BORING MACHINES

Foote-Burt Vert. 26" sw, new 1941
#49 Heald Borematic, new 1944
3½ Bar Cinn-Gilbert Table Type

DRILLS

1 spdl. 14" sw, #2 Avey, new 1945
1 spdl, 20" sw, #2LMS L-G, 1945
1 spdl, 24" sw, #2MAG Avey, new 1942
1 spdl, 26" sw, #1MS L-G hydraulic
2 spdl, 24" sw, #3 Avey, AC MD
3 spdl, 20" sw, #2LMS L-G, 1942
3 spdl, 24" sw, #3MS L-G, new 1943
4 spdl, 14" sw, #2LMS L-G, new 1942
6 spdl, 20" sw, #1LMS L-G, new 1943
#314-A Baker Univ. H.D., 1943
16 spdl. Fox #K60H, #2 taper, 1944

GRINDERS

3"x12" #5 B&S, Rap. Trav., 1948
3"x18" #5 B&S, Rap. Trav. 1943
4"x18" No. 4H Landis 1943
6"x18" Norton Type C, new 1942
10"x18" Norton Type C, new 1943
10"x36" Norton Type C, new 1942
10"x48" Norton Type C, new 1943
10" (28" sw.) x 48" Cinn. ER, 1943
10"x50" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"x36"x36" Norton, angular wheel
14"x72" Norton Type C, new 1941.
16"-40"x96" Norton Gap, 1942
16"x72" Hill-Clarke, A.C. Mot. Dr.
16"x26"x72" Norton, AC MD 1941
18"x96" Hill-Clarke, AC Mot. Dr.
18"x120" Norton, AC MD
24"x264" Norton, AC MD, Rebuilt
26"-32" Gap x 114" Norton Pl. Cyl.
42"x72" Norton, extras, new 1947
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1942
#16-38 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Sizematic, 1944
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc. 1940
#3 R Abrasive Surf, 8"x24", 1943.
#18-30" Blanchard Rot. Surf.

LATHES

16ML-16"x36" LeBlond Auto.
#16ML-16 LeBlond, Semi-Auto, 36" cc
13"x30" Hendey Lathe, Taper Att.
13"x28" Lipe Carbo Semi-Auto
13"x33" Fay Automatic
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14"x36" Amer. Grd. Hd., MD
27"x84" Amer. Grd. Hd., MD
24"x42" Fay Auto. AC MD
36"x126" Putnam Grd. Hd., MD
614 Seneca Falls, 16"x36", 1942
120"x96" cc N-B-P, ser. 2350
#54S Cinn Arrow Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-10 Libby H.D. Tur. 1942
#4A W&S Turret, new 1944
4FU Fastermatic, tur, 2¾" sw. 1944
#40 Potter & Johnston, new 1941

MILLERS

54"x30"x16 Ingersoll Slab, 1934
54"x8' Ingersoll Openside, 1942
54" Ingersoll Vertical Bot.
#6V Davis & Thompson Vert., 1944
#12-B Pratt & Whitney Profilers
10"x60" P&W Mod. B. Thread Mill
#LT 6"x72" L B Thread
#CT L-B Thread Mill new 1942
No. 2 Cinn. Univ. Hi-Power
#26 Van Norman, Rebuilt, 1941
#1-18 Van Norman Prod. 1942
1846-M K&T Simplex

PLANERS

36"x36"x12' Rockford Openside '42
60"x48"x27' American, 4 hds.
60"x48"x30' Hamilton, 4 heads

MISCELLANEOUS

6" Goss & DeLeeuw 6 spdls. 1941
#306 Barnes Vert. Hone, new 1942
15 Ton Hyd American Press, 1946
#11RD 2 Hd. W&S Tapper, latest
#36BM G&E 2 Spdl. Bevel Gear
#61A Fellows Gr Shaper 18" cam
#HRS Barber-Colman Sharp Mach
18 T Toledo Overhead Crane, 29½' Refl— p 2.CA

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TOCCO 200 KW, 3,000 cy. 1943
TOCCO 80 KW, 10,000 cy. 1943
WARNER & SWASEY #3 Air Chuck & cyl.
GISHOLT #3, Air Chuck & Cyl. 1943

GISHOLT 1L, bar feed, C.S. turret, 1943
BULLARD 42", VTL Side Head
LAPOINTE, Vert. Broach 20T, 90" st. 1941
CINN. Cyl. Grinder 6x18 Plunge 1945
CINN. Cyl. Grinder, 10x18 Plunge 1941
CINN. Cyl. Grinder, 18x72 Plunge 1943
NORTON Cyl. Grinder, 6x18 Plunge 1944
HANCHETT #900 Face Grinder 1944
ROCKFORD Hyd. Vert. Shaper, 12" st. 1944
GRAY DH Planer, 60x60x12, 4 heads, DC drive
BETTS DH Planer, 84x84x16, 4 heads DC drive
SOMMER & ADAMS Thread Mill, 18", H.I.S. 1943
BIGNALL & KEELER 8" pipe threader, 1949
BIGNALL & KEELER 12" pipe threader, 1949
BLISS 312 W, SSBC, 665 Tn, 14" stroke, 43"x50" bed, 1947

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*Grinder—#16A-2 Blanchard Autom Surf '40
*Induction Heating Unit—75 KW Tocco, 3 Sta '44
*Lathe—20x84 Sidney H.D. 32 speed T.R. Mod '52
*Lapper—Cinc Centerless, Filmatic '51
*Mill—#2 B&S Horiz w/vert head, 5 HP '48 $4450
—#2H K&T Vert. Mier Stops, 5 HP '42 $5050
*Press—150 Ton #8½ Verson OBI w/cush. '45
#802 HPM Inj. Moulding, New Controls
*Shaper—36" Rockford Openside, S.&R. Heads '43
*Thread Mill—CT-36 Lees Bradner Univ '44 $2950
*Gear Hobber—Barb-Cole #3 Prec (Rebuilt) $3250
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*Grinder Int.—72A Heald T.R. Mod, C Feed Head T. Stock '45
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#10 Sundstrand F&R Slides
#12 Sundstrand F&R Slides 1952
8x21 Fay Automatic (1944)
12x33 Fay Automatic Lathe (New) ½ Price
*Mills: Prod.—4-48 Cinc Simplex "Hypowermatic"
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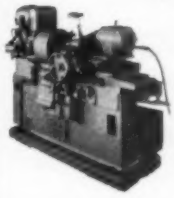

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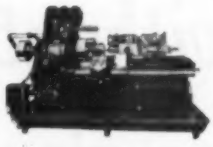

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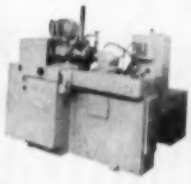

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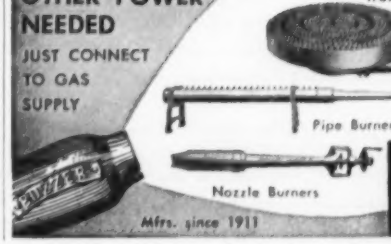

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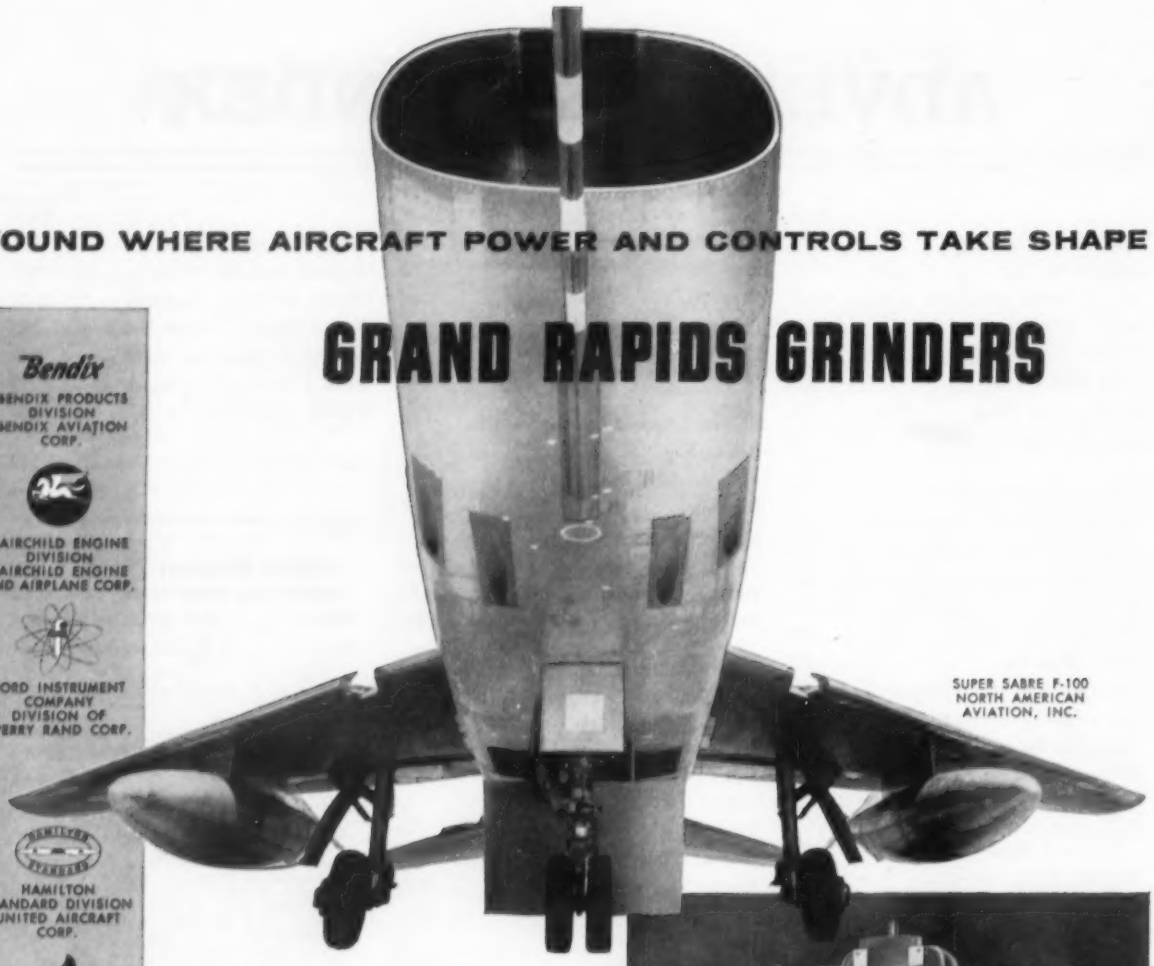

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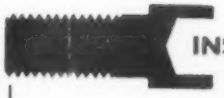


INSIDE INFO FROM HOLO-KROME

Holo-Krome sockets completely forged!

THE SECRET'S IN THE SOCKET!

Since 1932, H-K has completely forged socket screws for greater strength where needed. Originally developed by Holo-Krome, cold-forming maintains metal fibers intact for greater strength. No drilling or broaching to weaken an H-K socket wall. You get tougher screws when they're H-K's!

Compare These Other H-K Features!

SCIENTIFICALLY DESIGNED SOCKETS . . . depth carefully proportioned to give greatest head and socket strength, firmest key grip.

SHARP HEX CORNERS . . . carefully formed socket corners resist internal reaming.

UNTAPERED WALLS . . . for better key fit, longer key and socket life, even tighter wrenching.

For the finest in Socket Screw products . . . for revolutionary SAME-DAY SERVICE, the name to remember is Holo-Krome!

LOOK INSIDE A HOLO-KROME SOCKET!

Send in the coupon below and we'll send you FREE an H-K Socket Cap Screw (we've omitted heat treating to let you get a better look at the mirror finish and sharp hex corners under the usual black finish). Look it over carefully, and see for yourself what a real difference H-K quality and skill can make!

Please send me FREE a Holo-Krome Socket Screw for my inspection.

NAME _____

POSITION _____

COMPANY _____

ADDRESS _____

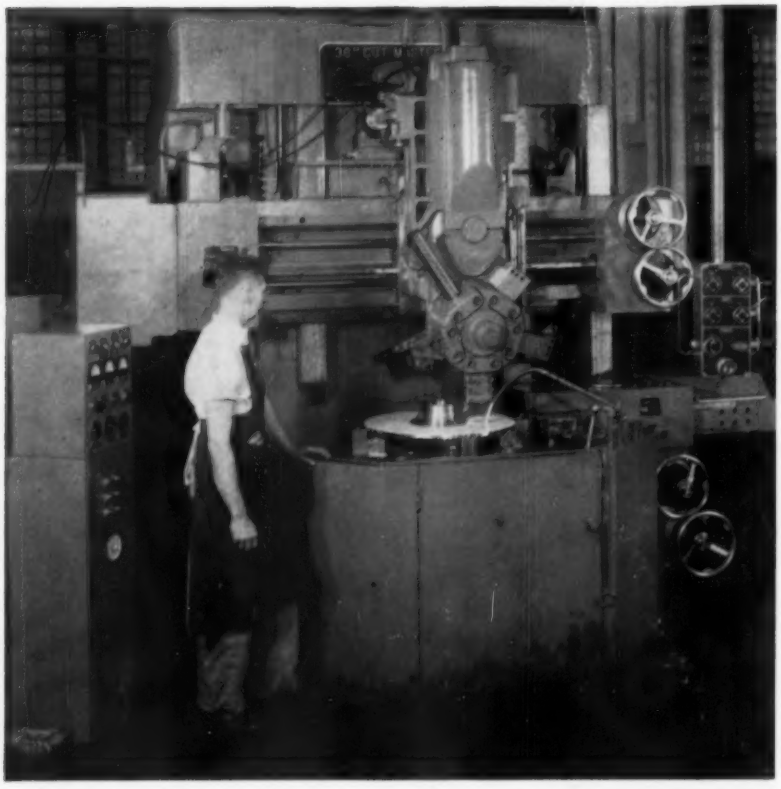
CITY _____ ZONE _____ STATE _____

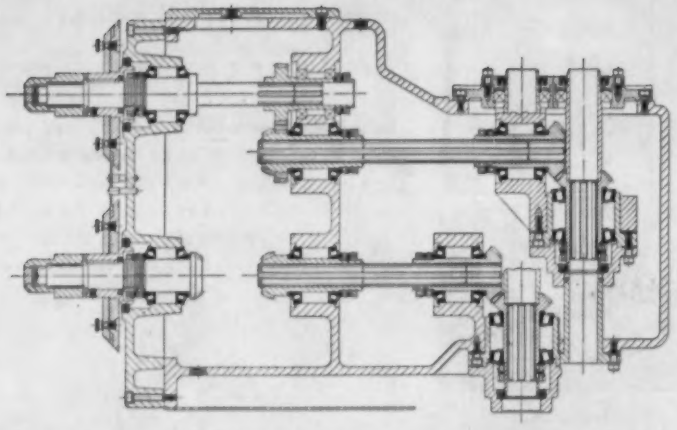
HOLO-KROME

THE HOLO-KROME SCREW CORP., HARTFORD 10, CONN.

Sold only through authorized Holo-Krome distributors.

TIMKEN® bearing equipped . . . 1 lathe replaces 4, cuts machining time 81%





How **THE BULLARD COMPANY** mounts 16 Timken tapered roller bearings in the Hand Wheel Brackets of their vertical turret lathes.

THIS new Bullard 36″ Cut Master Vertical Turret Lathe, turning out hub discs and cover discs for turbo wheels at the York Corporation, York, Pa., has cut machining time an average of 81%. And does all the operations formerly done on 1 horizontal turret lathe, 2 engine lathes, and 1 older vertical turret lathe! Timken® tapered roller bearings play a major role in this production story.

16 Timken bearings in the hand wheel bracket—and other Timken bearings in the headstock and feed works—maintain precision, locate shafts and gears, hold integral parts in accurate alignment. Reduce wear.

Maintenance costs are low, with Timken bearings built to last the life of the lathe. Friction is practically eliminated, conserving power. Timken bearings are geometrically designed, precision-manufactured, to give *true rolling motion.* To insure highest quality, we even make our own fine alloy steel—which no other American bearing maker does.

Look for the trade-mark "Timken" on each bearing! The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN TAPERED ROLLER BEARINGS ROLL THE LOAD

TRADE-MARK REG. U. S. PAT. OFF.